“Scents and Sensitivity: The Emotional Valence and Flexibility of Afrikaans Taste and Smell Adjectives”

by

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Declaration

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Abstract

The present study investigated the influence of perceptual experience on the emotional valence of Afrikaans adjectives associated with smell and taste, as well as the emotional valence of the contexts within which these adjectives occur. This study has three research questions, the first of which is "In comparison to adjectives associated with other sensory modalities, to what extent are Afrikaans taste and smell adjectives emotionally valenced?", the second of which is "In comparison to adjectives associated with other sensory modalities, to what extent do Afrikaans smell and taste adjectives appear in highly emotionally valenced phrases?", and the third of which is "In comparison to adjectives associated with other sensory modalities, to what extent are Afrikaans taste and smell adjectives emotionally flexible?".

This study consisted of two norming studies and a corpus study. In the first norming study, 60 Afrikaans adjectives were normed for sensory modality and valence by 78 native Afrikaans speakers. In the second norming study, 344 Afrikaans nouns were normed for valence by 140 native Afrikaans speakers. Occurrences of phrases consisting of these adjectives and nouns in the VivA (Virtuele Instituut vir Afrikaans) Korpusportaal Omvattend 1.9 (2021) corpus were analysed.

The results of this study are inconsistent with previous findings that smell and taste words are significantly more emotionally valenced and appear in more emotionally valenced and flexible contexts than words associated with the other sensory modalities. It was found that Afrikaans taste and smell adjectives are only marginally more emotionally valenced, and this valence does not extend to the phrases in which these adjectives occur. This challenges the idea that sensory language is embodied to the extent that it influences patterns in language use and highlights the need to study a variety of languages to draw conclusions about the embodiment of sensory language.

Opsomming

Hierdie studie het die invloed van perseptuele ervaring op die emosionele waarde van Afrikaanse byvoeglike naamwoorde wat met reuk en smaak verband hou, sowel as die emosionele waarde van die kontekste waarbinne hierdie byvoeglike naamwoorde voorkom, ondersoek. Hierdie studie het drie navorsingsvrae. Die eerste navorsingsvraag is: "In vergelyking met byvoeglike naamwoorde wat met die ander sensoriese modaliteite verband hou, tot watter mate word Afrikaanse smaak- en reukbyvoeglike naamwoorde emosioneel gewaardeer?". Die tweede navorsingsvraag is: "In vergelyking met byvoeglike naamwoorde wat met die ander sensoriese modaliteite verband hou, tot watter mate verskyn Afrikaanse smaak- en reukbyvoeglike naamwoorde in hoogs emosioneel gewaardeerde frases?" en die derde navorsingsvraag is: "In vergelyking met byvoeglike naamwoorde wat met die ander sensoriese modaliteite verband hou, tot watter mate is smaak- en reukbyvoeglike naamwoorde emosioneel buigsaam?".

Hierdie studie het uit twee normeringsstudies en 'n korpusstudie bestaan. In die eerste normeringsstudie is 60 Afrikaanse byvoeglike naamwoorde deur 78 moedertaal Afrikaanssprekendes volgens sensoriese modaliteit en emosionele waarde genormeer. In die tweede normeringsstudie is 344 Afrikaans selfstandige naamwoorde deur 140 moedertaal Afrikaanssprekendes volgens emosionele waarde genormeer. Die voorkoms van frases wat uit hierdie byvoeglike naamwoorde en selfstandige naamwoorde bestaan, in die VivA (Virtuele Instituut vir Afrikaans) Korpusportaal Omvattend 1.9 (2021) is ontleed.

Die resultate van hierdie studie is in stryd met vorige bevindings dat reuk- en smaakwoorde aansienlik meer emosioneel gewaardeer is en in meer emosioneel gewaardeerde en emosioneel buigsame kontekste voorkom as woorde wat met die ander sensoriese modaliteite verband hou. Daar is gevind dat Afrikaans smaak- en reukbyvoeglike naamwoorde slegs effens meer emosioneel gewaardeer word, en dat hierdie emosionele waarde nie tot die frases waarin hierdie byvoeglike naamwoorde voorkom, strek nie. Hierdie bevinding daag uit die idee dat sensoriese taal afhanklik van sensoriese persepsie tot die mate dat dit patrone in taalgebruik beïnvloed, is. Dit beklemtoon die behoefte om 'n verskeidenheid tale te bestudeer om gevolgtrekkings oor die beliggaming van sensoriese taal te maak.

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1. Introduction

Smells and tastes are central to the human experience. They regulate human behaviour and are deeply connected with emotion. We are attracted to certain smells and flavours and repelled by others, often linked with survival (Martin, 2013:xv; Herz, 2005:15). Our first warning sign that food has spoiled and is therefore no longer safe to eat, is often its smell or flavour. The fact that humans are attracted to pleasant smells and will go out of their way to surround themselves with attractive smells is illustrated by the success of the perfume industry. Furthermore, various studies have revealed that gustation and olfaction, sometimes collectively referred to as the 'chemical senses' or 'chemosenses', are physiologically linked to emotion and behaviour (see Volkow, Wang and Baler, 2011; Phillips and Heining, 2002).

According to the embodied cognition framework, the structure of the human mind is dependent on our physical interaction with the world, both through our bodies and minds (Gallese and Lakoff, 2005:456). This structure extends to language. Therefore, the behavioural, physiological and emotional effects of smells and tastes are expected to be reflected in language (Winter, 2016:976). This was investigated by Winter (2016), who found that, compared to words associated with other sensory modalities, words associated with olfaction and gustation tend to have higher emotional valence and tend to occur in phrases with higher emotional valence. They are also more flexible in this regard: the same smell and taste words can be found in strongly positive and strongly negative phrases. Winter's (2016) findings support the embodied cognition framework. In light of these findings, he proposes the Embodied Lexicon Hypothesis (ELH), which, in its simplest form, states that "language mirrors perception" (Winter, 2019:81). Sensory perception shapes language, particularly sensory language, and therefore associations between senses mirror associations in sensory language. Similarly, differences in the senses should result in predictable differences in language associated with these different senses (Winter, 2019:81).

However, these findings are based on English words only and cannot necessarily be assumed to apply to other languages. Not only are languages diverse in a general sense, but other studies have found significant differences in smell and taste lexicons of different languages (e.g. Majid

and Burenhult, 2014). This raises the question of whether these patterns of language use which mirror perception, as proposed by the ELH, are also present in languages other than English. The present thesis aims to address this by investigating sensory language use, specifically the emotional valence of Afrikaans smell and taste adjectives and the phrases in which they appear, in order to broaden our understanding of the embodiment of sensory language.

1.1. The scope of the present study

The starting point for the present study is Winter's (2016) study, with a few key differences. Firstly, Winter (2016) used sets of existing norms collected by Lynott and Connell (2009, 2013) and Warriner, Kuperman and Brysbaert (2013), and Winter (2016). Since there is no such data for Afrikaans, similar norming tasks were conducted on a smaller scale as part of the present study. Secondly, Winter (2016) used valence and modality norms for three parts of speech: adjectives, nouns and verbs. Because collecting this norming data forms part of the present study, only one of these parts of speech is focused upon in the present thesis in order to stay within the scope of an MA thesis. Adjectives were central to Winter's (2016) analyses and therefore the present thesis focuses on adjectives. Finally, the present study is conducted on an overall smaller scale than Winter's (2016) study, using fewer total words and norms. However, since the findings of Winter's (2016) study were robust, subsequent studies should be able to detect such effects even on a smaller scale. The methodology of the present study can be applied to other languages like Afrikaans, for which extensive norming data do not exist.

1.2. Project aims and research questions

This study explores the extent to which Afrikaans taste and smell adjectives are emotionally valenced in comparison to adjectives associated with the other three modalities (sight, hearing and touch), as well as the frequency of their occurrences in emotionally laden phrases. The following research questions address these aims:

1. In comparison to adjectives associated with other sensory modalities, to what extent are Afrikaans taste and smell adjectives emotionally valenced?

2. In comparison to adjectives associated with other sensory modalities, to what extent do Afrikaans taste and smell adjectives appear in highly emotionally valenced phrases?
3. In comparison to adjectives associated with other sensory modalities, to what extent are Afrikaans taste and smell adjectives emotionally flexible?

Based on the previous findings on English (Winter, 2016), it is hypothesised that Afrikaans smell and taste adjectives will be significantly more emotionally valenced than adjectives associated with the other sensory modalities. Furthermore, it is hypothesised that not only do adjectives associated with the chemosenses appear in more highly emotionally valenced phrases than adjectives associated with the other senses, but they also appear in phrases that vary to a significant extent in terms of emotional valence, suggesting that the adjectives themselves are emotionally flexible.

1.3. Methodology

This study consists of two norming studies as well as a corpus study. Norming Study 1, completed by 78 native Afrikaans speakers, has the purpose of establishing valence and modality norms for 60 Afrikaans adjectives. It consists of a series of rating tasks, in which participants are first asked to rate adjectives according to the extent to which they associate it with each of the five traditional senses, and then rate each adjective according to emotional valence. Norming Study 2, completed by 140 native Afrikaans speakers, has the purpose of establishing valence norms for a total of 344 Afrikaans nouns. It is similar to Norming Study 1, except that it does not include a modality norming section. Hence, the nouns are only normed for valence. The corpus used in the current study is the VivA (Virtuele Instituut vir Afrikaans) Korpusportaal Omvattend 1.9 (2021), also referred to in the present thesis as the VivA corpus. This is searched to yield a list of the occurrences of the adjective-noun phrases made up of the normed adjectives and nouns.

The present study makes use of a quantitative methodology. All the data are analysed using LibreOffice Calc and JASP 0.14.3. In three sets of analyses, three one-way ANOVAs are

performed, one related to each of the three research questions of the present study. The first ANOVA is performed to investigate the interaction between the modality and valence of the 60 adjectives included in the study, using the data from Norming Study 1. The second ANOVA incorporates the data from Norming Study 2 in order to investigate the interaction between the modality and valence of the phrases in which the 60 adjectives occur in the VivA corpus. The third ANOVA tests the interaction between the modality and emotional variability of the phrases within which the 60 adjectives occur in the VivA corpus. Post-hoc comparisons are performed to interrogate the specific relationship between the modalities.

1.4. Thesis structure

The structure of this thesis is as follows:

Chapter 2 consists of a Literature Review, in which an overview of relevant literature is given. It focuses firstly on the chemosenses and their role in human perception, and then on their relationship with the emotions. Subsequently, an overview of the relationship between the chemosenses and language is given, followed by findings regarding the chemosenses and emotional language.

Chapter 3 is the Theoretical Framework and outlines the theory of the present thesis. First, it discusses the five senses model and justifies its use in the framework of the present study. Subsequently, the focus moves on to the embodied cognition framework. Different views on embodiment are discussed, and the ELH and its views on embodiment are aligned with the present thesis.

Chapter 4, the Method, details the procedures followed to answer the research questions posed by the present thesis. This includes an outline of the two norming studies, as well as the corpus study.

Chapter 5 consists of the Results. It contains an outline of the steps taken to analyse the data and reports the results of this analysis.

Chapter 6 is the Discussion and Conclusion of the present thesis. It consists of a discussion of the results reported in the previous chapter, as well as some concluding remarks. The significance of the findings as well as their implications for the field of cognitive linguistics, particularly regarding embodied cognition, the ELH, sensory language, and emotion are discussed. The limitations of the present study are also set out in this chapter. Potential adjustments to the present study, as well as suggestions for future related studies, are given.

2. Literature review

The current chapter reviews the relevant literature on the chemosenses – the senses of smell (olfaction) and taste (gustation) – with a focus on their relationship with the emotions, language, and emotional language. First, the chemosenses are introduced and their similarities and differences highlighted. Despite being traditionally regarded as minor senses, it is argued that they play an important yet underrated role in our experience of the world, especially when it comes to survival and emotion. This is followed by a discussion of the relationship between the chemosenses and emotion, with references to findings from studies on memory, biological reward mechanisms, chemosensory research and marketing. Then, the relationship between the chemosenses and language is discussed. It is argued that although this relationship has traditionally been seen as weak, substantiated by findings based on languages in which odours and flavours are difficult to name, recent evidence shows that chemosensory perceptions are not difficult to name and describe in all languages. Subsequently, evidence for the embodiment of experiences of emotional valence reflected in language is given. Finally, the relationship between the chemosenses and emotional language is discussed in terms of literature suggesting that the relationship between the chemosenses and emotion is reflected in sensory language.

2.1. The chemosenses

2.1.1. The minor senses

Olfaction (smell) and gustation (taste) are traditionally regarded as the minor senses, as opposed to the more major senses of vision (sight), audition (hearing) and somasensation (touch). Scholars like William James (1892:70) and Sir Victor Negus (1958) have even argued that the senses of smell and taste are not significant enough to make them worthwhile subjects of study. However, not all scholars share this view and now olfaction and gustation have become notable subjects of study in the neurological and psychological sciences, as well as linguistics.

2.1.2. Similarities and differences

Although olfaction and gustation are considered different senses within the five senses model, they have important similarities that distinguish them from the other three senses and cause them to often be lumped together for the purposes of certain studies, this one included. Olfaction and gustation are known collectively as the chemosenses because they respond to chemical stimuli that form bonds with receptors, thus creating a sensation (Martin, 2013:1). This is one of the main characteristics distinguishing them from vision, audition and somasensation. However, despite the chemosenses being mostly considered collectively in the current thesis, it is important to acknowledge their differences. What distinguishes them from each other at a basic and intuitive level is the way in which the stimulus is received. Taste sensations happen when tastants come into contact and react with the taste buds on the tongue. Smell sensations happen when odorants present in the air are inhaled through the nostrils and then processed by the olfactory apparatus (Martin, 2013:2). This kind of breathing is known as orthonasal breathing. Another kind of breathing that leads to smell sensations is retronasal breathing. It is through retronasal breathing that olfaction and gustation interact to result in flavours. Food contains odorants and when it is put into the mouth, these odorants stimulate odour receptors at the back and top of the throat, which then send signals to be processed by the olfactory apparatus. This is why when we have a blocked nose, we cannot perceive food flavours as well as odours: we cannot receive flavour through retronasal breathing due to the blockage (Martin, 2013:2). Therefore, it is clear that although the chemosenses differ, they interact and both play an integral part in perceiving chemical stimuli such as those found in food and beverages.

2.1.3. Why "minor" senses?

As mentioned above, the chemosenses are often considered to be "minor" senses, upon which we do not rely to navigate the world to the same extent as the other three senses. There is an evolutionary argument for this: odours are heavy and therefore tend to exist near the ground. So, when humans abandoned quadrupedality and began to walk on two limbs instead, we breathed cleaner air that contained fewer odours and we could see further, and therefore started relying more on our other senses like vision to navigate and regulate behaviour (Martin,

2013:xiv). Furthermore, taste can only be experienced if stimuli come into contact with the tongue, which became less common as we stood up and such stimuli were no longer so easy to access and taste. As more minor senses, the chemosenses are regarded by many not as something we rely on heavily for daily activities and survival, but rather as a source of distraction and enjoyment or disgust. Many would, given the choice, choose to lose their sense of smell or taste over losing their sense of sight or hearing (Martin, 2013:xiv). According to a survey of 7000 participants between the ages of 16 and 30, half of young people would choose to lose their sense of smell over losing an electronic device such as a laptop or phone (McCann Truth Central, 2012:6).

2.1.4. The underestimated senses

Martin (2013:xiv-xv) argues, while acknowledging that olfaction is a minor sense when compared to vision and hearing, that its significance is underestimated. This is mainly because this sense is extremely reliable in most cases, and we do rely on it to a large degree. Our sense of smell is what prevents us from drinking spoiled milk, which is often visually identical to fresh milk. Failure of the sense of smell is rare and only noticeable when it is significant, such as when the nose is blocked during a cold and we can no longer smell or taste food (Martin, 2013:xv). Olfaction is also extremely sensitive and effective. It has been said that the human olfactory sense is more sensitive than a smoke detector (Martin, 2013:xv) and a gas chromatograph, which is a device that separates different gases and can be used to identify them (Cain, 1977:796-798).

2.1.5. The chemosenses and survival

Previously it was mentioned that the chemosenses are often considered minor senses, not relied upon for survival to as great degree as, for example, vision. However, this may not actually be the case. These senses are, as put by Martin (2013:xv), "essential for stopping us from killing ourselves". We often have strong emotional reactions to smells and tastes, ranging from extreme pleasure to disgust. Stimuli that elicit pleasure attract us, and stimuli that elicit disgust repel us. Street vendors use this principle to attract customers: placing a fan behind a pan of

frying pancakes effectively blows the smell of the pancakes out into the street, reminding potential customers that pancakes exist, are delicious, and now that they think about it, it has been a while since they have eaten and they could go for a pancake right now. Even if they do not actually purchase the pancakes, they might walk slower and closer to the vendor's stall. The same potential customer might then walk past a clogged sewer, screw up their nose and walk away quickly until the air smells more pleasant. This is about survival: we are unlikely to be harmed by a pancake, but a sewer is the ideal breeding ground for pathogens that might kill us. It is clear that although the chemosenses are not considered to be dominant senses, they still play an integral part in our perception of the world.

2.2. The chemosenses and emotion

According to Martin (2013:xiv), "life without either [smell or taste] is like sight without colour or like somasensation experienced through rubber gloves". That is, we can mostly get by without them, but they make living in the world a significantly richer experience. The relationship between the chemosenses and emotion is strong, an intuitive fact that is substantiated by a large body of research. The literature strongly suggests that the chemosenses are the most emotional of the senses, in part because of their intrinsic connection with food. Coppin (2020) posits that the current COVID-19 pandemic and the predicted widespread loss of the senses of taste and smell resulting from the virus will draw attention to the emotional aspects of these senses. Furthermore, a widespread loss like this will highlight the true extent of the role that the chemosenses play in our lives.

2.2.1. Other senses play a role in perceiving food

Some of the below focuses on taste and smell being connected with the emotions because of the role they play in perceiving food and beverages. However, it is important to note that we do not only smell and taste food. Foods and beverages are, unlike most other things, experienced through all five senses: in addition to how they smell and taste, their visual aspects can be seen before consumption, texture is felt during consumption and biting and chewing elicits sounds. Taste has been shown to play a primary role in the perception of food by infants

(Bakalar, 2012:S4). However, as we grow older and begin to recognise foods and form preferences, other senses like vision and audition begin to play a role. Even images of food can increase the production of saliva in anticipation of eating, and when eating potato chips is accompanied by a crunching noise, the chips are perceived to be fresher (Zampini and Spence, 2010). Furthermore, texture plays an important role in perceiving foods, especially when it comes to foods with high fat content, which is what gives foods like yoghurt and ice-cream their distinct creamy mouthfeel. Smell and taste only form part of the full experience of food. However, the chemosenses, especially taste, are used to perceive food to a far greater extent than any other type of stimuli. Therefore, it can be said that the connection between the chemosenses and food is greater than that between any of the other senses and food.

2.2.2. The chemosenses and memory

The chemosenses are intimately linked with memory. It has been shown that odours can evoke vivid episodic memories (Saive, Royet and Plailly, 2014:1), which are long-term memories of specific events in a person's life (Tulving, 1972:385). The intensity of such effects has been shown to be unique to odours, in comparison with visual stimuli, as evidence by a study by Herz (2000:957-964). In this study, thirty-six participants were presented with an image of a painting accompanied by either a visual or odour cue. These cues were all easily recognisable and familiar to the participants, and consisted of, for example, pieces of real banana for the odour cue and a plastic banana for the visual cue. After all the stimuli were removed, participants were asked to rate how well they could visualise the painting and also detailed their emotional response to the painting. This procedure was repeated by the same participants after 48 hours, with the only difference being that half the odour cues were replaced verbal cues in the form of audio clip of somebody saying the name of the cue, for example *banana*, repeatedly (Herz, 2000:958-959). The responses showed that the verbal cues evoked a weaker memory of the participants' emotional response to the painting than the odour cues. When compared to the visual cues, however, there was no significant difference (Herz, 2000:960). The study therefore shows that odours not only facilitate recall memory, but also elicit stronger emotional responses than both visual and verbal stimuli.

In a second similar experiment, participants were presented with an image of a painting accompanied by either an odour cue or an instruction to imagine a certain odour, referred to as an 'odour-imagine' cue. For example, they would either smell a banana or they would be told to imagine the smell of a banana, thereby eliciting a mental image of the smell of a banana (Herz, 2000:961). The effectiveness of the actual odour cues was found to be significantly higher than the odour-imagine cues. That is, the odours evoked better and more emotional memories than their odour-imagine counterparts (Herz, 2000:961-962). This further highlights the effectiveness of odours as memory cues, particularly with regard to emotions.

A more recent study by De Bruijn and Bender (2018:547-558) also compares olfactory cues with visual cues, but with regard to autobiographical memories, which are memories of events that were experienced personally (Conway and Pleydell-Pearce, 2000:261). One hundred and seventy participants took part in this study. First, participants completed a short baseline task, in which they smelled two odours and provided a brief description of a memory from their childhood evoked by these odours and answered a few questions about the memory. Then, participants were randomly assigned one of two conditions: an olfactory cue condition and a verbal cue condition. They were subsequently presented with the cue, after which they were required to give a detailed description of a memory they associated with that cue. They also rated the memory on how vivid, emotionally laden and detailed it was. The procedure was then repeated with a second cue (De Bruijn and Bender, 2018:552). It was found that odours are more effective triggers for memory than visual stimuli, and that the memories triggered by odours are more emotionally laden than those triggered by visual stimuli.

2.2.3. The role of taste and smell in biological reward mechanisms

It has been shown that food is linked to the reward system to the extent that impairments in the neural mechanisms involved are associated with overeating and obesity (Volkow, Wang and Baler, 2011). The neurotransmitters involved in the perception of food include dopamine, cannabinoids, opioids, orexin, leptin and ghrelin, the most influential and well-studied being dopamine. Dopamine is also associated with the rewarding effect of drugs (Volkow et al., 2011:39). Of course, there are various characteristics of food other than its flavour or aroma, such as texture and nutritional content, some of which influence how they affect reward

mechanisms. Foods with a high sugar and/or fat content are a more potent trigger because when food is scarce, fats and sugars can be stored to facilitate survival. Essentially, these reward systems are in place to motivate people to consume food for survival (Volkow et al., 2011:39). Odours and flavours play a part in this, particularly when it comes to conditioning. When someone is repeatedly exposed to a food that triggers a reward response – such as a fatty or sugary food – eventually even the smell of that food can trigger the release of dopamine (Epstein, Temple, Roemmich and Bouton, 2009; Schultz, 2010). Opioid, cannabinoid and GABA neurotransmitters are also associated with the hedonic characteristics of food. Like dopamine, these are also associated with the rewarding effect of drugs. Therefore, it is clear that biological systems related to emotions are also related to various characteristics of food, including smells and tastes.

2.2.4. The use of hedonic scales in chemosensory research

Emotional response is very important when it comes to perceiving odours. This can be seen by the prevalence of hedonic scales in odour research, where odours are rated according to how pleasant or unpleasant they are. These categories are certainly not objective and differ from person to person according to preference, but there are some patterns. A vanilla scent is more likely to be perceived as pleasant, whereas the smell of vomit is generally considered to be unpleasant. These categories often have to do with survival: vanilla is usually safe to touch and consume, whereas the disgust triggered by the smell of vomit prevents us from interacting too closely with it, as it is unsafe to do so. It has been shown that in general, people will decide whether they like or dislike an odour first, before any other response, such as a judgement of sweetness or floweriness (Khan, Luk, Flinker, Aggarwal, Lapid, Haddad and Sobel, 2007). It has also been shown that the speed at which an odour's pleasantness is assessed is dependent on the odour's degree of pleasantness: odours that are perceived to be more unpleasant are assessed faster than more pleasant odours (Bensafi, Pierson, Rouby, Farget and Bertrand, 2002). Hedonic valence plays a primary role in the conceptualisation of odours – more often than not, we cannot experience a smell or taste without an emotional reaction (Poulton, 2020).

2.2.5. Using smells to sell

As mentioned previously, smells can attract people. The retail industry has taken advantage of this fact to attract customers and encourage them to buy. Spangenberg, Crowley and Henderson (1996) investigated this by creating a simulated shop environment with twelve scent conditions, as well as one control condition which was unscented. In the scent conditions one of two pleasant scents was released into the room via a scent diffuser at one of three possible intensities. Two hundred and ninety-eight participants were each exposed to one of these thirteen conditions. They were required to explore the shop and evaluate the store on overall impression, environment, merchandise, specific products, their intentions to visit the shop and purchase intentions for specific products. They were also asked how long they thought they spent in the shop, which was compared to how long they actually spent inside. Finally, the number of products each participant examined was recorded. The findings show a significant difference in how participants evaluated and behaved in the simulated shop environment depending on the scent and no-scent conditions. There were no significant differences depending on the nature of the scent itself or its intensity. Overall evaluations of the shop as well as evaluations of the merchandise were more positive in the scent conditions. Furthermore, although the actual time participants spent in the store did not differ significantly between the scent and no-scent conditions, participants in the scent condition perceived the time to be shorter than those in the no-scent condition (Spangenberg et al., 1996:74-76). Therefore, even the presence of a scent can make customers feel more positive about being in a retail environment than if the environment is unscented. This study shows that emotional state can be influenced by odour.

2.2.6. Taste perception is altered by emotion

It has also been found that taste perception can change depending on emotional state (Noel and Dando, 2015). Noel and Dando (2015) collected data from a total of 550 participants who attended hockey games throughout a season. Sports games have been shown to elicit strong emotions and data was collected throughout the season to capture a variety of positive and negative emotional states (Noel and Dando, 2015:90). These participants tasted different flavours of ice cream, namely salted caramel pretzel and lemon/lime sorbet, which encompass

the basic tastes. They then rated these on the intensity of perceived sweetness, saltiness, bitterness, umami, sourness and creaminess. They also rated how much they liked the ice cream. Finally, they rated how satisfied they were with the outcome of the game they had attended. It was found that the outcome of the game influenced the perceived intensity of sweetness, sourness and creaminess, but there was no significant effect on the perceived intensity of salty, umami and bitter tastes. Positive satisfaction ratings positively correlated with increased sweet intensity and decreased sour intensity (Noel and Dando, 2015:92). Therefore, this study shows that taste intensity is connected to emotion in the sense that some tastes are perceived differently depending on the emotional state of the perceiver.

2.3. The chemosenses and language

2.3.1. Ineffability

Ineffability can be defined as "the difficulty or impossibility of putting certain experiences into words" (Levinson and Majid, 2014:408). Experiences may either have weak ineffability, meaning they cannot be described in some languages, or they may have strong ineffability, meaning they cannot be described in any language (Levinson and Majid, 2014:410). For example, the basic colour vocabulary is not the same in all languages. English has terms for "red", "green" and "blue", whereas Pirahã does not (Everett, 2005). This means that the perceptual experience of these colours can be described using language, just not every language. In order to determine that something is truly strongly ineffable, one must compare a variety of different languages (Levinson and Majid, 2014:4).

It is important to note that when it comes to the ineffability of sensory perceptions, not all perceptions associated with one of the five senses are equally ineffable. Within these sensory modalities, there are some qualities that are easier to describe. Pain is more ineffable than texture, even though they form part of the same sensory modality (touch), and faces are more ineffable than geometric shapes, even though they form part of the same sensory modality (sight). However, if the sensory modalities are to be evaluated as a whole in terms of ineffability, vision is traditionally regarded as easiest to code linguistically, and smell is most

difficult (Levinson and Majid, 2014:415). Some studies contradict this view (see section 2.3.3.), by showing that, in some languages, the codability of olfactory perceptions is on par with that of visual perceptions.

2.3.2. Odours and flavours are difficult to name (in most languages)

The mysteriousness of olfaction and gustation may in part be attributed to the difficulty humans have with naming different smells and tastes in many languages. The relationship between olfactory perception and language is described by Herz (2005:1) as "contradictory and complex". This might be because, unlike most visual stimuli, odours have been shown to be difficult to name when they appear in isolation: that is, with no accompanying visual, auditory or somasensory stimuli (Herz, 2005:1-2; Yeshurun and Sobel, 2010:226; Huisman and Majid, 2018). This view has been held for centuries, with Kant (1798/2006:51) commenting that "[s]mell does not allow itself to be described, but only compared through similarity of another sense". More recently, Yeshurun and Sobel (2010) argue that it is identifying the hedonic quality of an odour, rather than its name, that is primary function of the sense of smell.

In a recent study, Huisman and Majid (2018) show that speakers of Dutch struggle to accurately name odours. Forty-two native Dutch speakers were presented with 24 odours one by one and asked "What smell is this?". They were also asked to rate the odours on their familiarity, frequency (how often they encountered the odour in their daily lives) and edibility. Their responses revealed that they only gave the correct name 26.3% of the time. However, the ratings revealed that the more familiar, frequent and/or edible the odour was, the more participants could name it accurately. This is an example of a study showing that odours are difficult to name in some languages.

The chemosenses are seen to be the most ineffable of the senses partly because in many languages, odour and flavour terms are source-based, rather than abstract. This means that the descriptors do not refer to the smell or taste alone but refers to the physical source of that odour (Lawless and Cain, 1975:336; Wilson and Stevenson, 20016:7). For example, in English one would say something *smells like jasmine* or *tastes fruity* because there are no abstract terms to

describe these experiences. Even expert sensory analysts use mainly source-based terms (e.g. Drake and Civille, 2003). English does have some abstract terms, such as *musty*, but there are far more abstract terms referring to visual stimuli. Colour terms, such as *turquoise* or *yellow*, for example, are abstract visual terms because they do not refer to any stimulus type other than visual.

The difficulty with naming odours in most languages may be attributed to evolution and survival. Herz (2005), whose research centres around the hedonic and emotional aspects of olfactory perception, puts forth an argument for the seemingly weak relationship between language and olfactory perception, based on evolution. This argument attributes the sparse odour vocabulary in many languages to necessity. It is not necessary to name odours to solve complex problems or have abstract thought processes. It is how we react to a smell, not how we name it, that is of the highest importance for survival. It follows, then, that naming smells is not of great importance from an evolutionary standpoint (Herz, 2005:15). However, as is discussed in detail in the next section, it has been shown that speakers of some languages have little to no problem naming odours in comparison with other sensory stimuli (e.g. Majid and Burenhult, 2014). It is therefore erroneous to assume that difficulty in naming odours is a universal human phenomenon. However, this is useful for the argument too: in some languages and cultures, naming odours – not simply reacting to them – is as important as naming other sensory stimuli. This suggests that, in these cultures, naming odours plays a role in their functioning. Overall, with some exceptions, languages do not tend to have an extensive abstract odour lexicon.

2.3.3. Odours are easy to name (in some languages)

As mentioned above, it is important to note that while the difficulty of naming smells and tastes is the case for most languages, it is not the case for all. Some recent research shows that speakers of Jahai (spoken in Malaysia), are just as good at naming olfactory stimuli as they are at naming visual stimuli (Majid and Burenhult, 2014). Ten native Jahai speakers were compared with ten native American English speakers on their ability to identify odours and colours. In the odour identification task, participants were presented with twelve odours one by one and were asked to name them. Overall, the English speakers gave a variety of different

responses for the odour terms, whereas there was significantly more agreement between the Jahai responses. This means that odours are significantly more codable in Jahai than in English. Furthermore, the majority of the odour terms given by the English speakers were source-based (e.g. *like a banana*) rather than abstract (e.g. *musty*), although responses ending in a -y, such as *fruity* were coded as abstract even though these terms are also arguably source-based. The Jahai speakers, on the other hand, described the odours using more abstract terms than source-based terms (Majid and Burenhult, 2014:268-269).

When it came to the colour identification task, in which participants were presented with 80 colour chips and asked to name each one, English speakers showed significantly more agreement in their responses than for the odour naming task. They also used far more abstract terms such as *blue*, rather than source-based terms such as *ash-coloured*, than in their odour responses. It was also found that colours are less codable in Jahai than in English, but there was no significant difference between the codability of colours and odours in Jahai. Furthermore, similarly to the odour names, the colour names given by the Jahai speakers were 99% abstract (Majid and Burenhult, 2014:269). This study therefore shows that speakers of Jahai can name odours just as easily as they can name colours and thus it cannot be assumed that the relationship between language and the chemosenses is intrinsically weak.

Another study compared Jahai speakers to Dutch speakers on their ability to describe odours (Majid, Burenhult, Stenmeyr, de Valk and Hansson, 2018). Thirty native Jahai speakers and 30 native Dutch speakers were presented with 37 odorants one by one and asked, in their native language, "What smell is this?". The responses from the Dutch participants were overall more diverse than those from the Jahai speakers and they used a variety of strategies such as evaluating the odour or referencing a possible source of the odour. The Jahai speakers described the odours using mainly abstract terms and there was significantly more agreement between their responses (Majid et al., 2018:3). This is consistent with the findings of Majid and Burenhult (2014). It was also found that Jahai responses were shorter than the Dutch responses. The average Jahai response length was five characters, which most of the time made up just one abstract smell term, whereas the average Dutch response length was 85 characters (Majid et al., 2018:3). The Jahai speakers also formed their responses faster than the Dutch speakers. The former responded in an average of 2 seconds, whereas the latter took an average of 13

seconds to respond (Majid et al., 2018:4). The findings of this study support those of Majid and Burenhult (2014) when it comes to the nature of odour descriptions in Jahai in comparison to another language. Furthermore, this study shows that speakers of Jahai can describe odours succinctly in and quickly in comparison to Dutch speakers.

The basic English odour vocabulary is small when compared to that of the other senses. However, this is not the case for all languages. A study by Wnuk and Majid (2014:125-138) has shown that a larger smell vocabulary is possible, with reference to the smell vocabulary of the Maniq language, a language spoken by groups of hunter-gatherers in Thailand. Eight native Maniq speakers participated in this study and were presented with 15 smell terms and asked "What smells [smell term]?". They were required to answer this question by listing some examples (Wnuk and Majid, 2014:129). The list of 15 terms was made up of words observed in both elicited and spontaneous language use. It was found that each of the smell terms could refer to a variety of sources, which means that these are abstract, not source-based, terms.

In a second experiment, 11 speakers of Maniq were presented with groups of three of the 15 smell terms used in the previous experiment. They were asked to decide which of the three was the least similar to the others. The aim of this experiment was to discover the organisation of the Maniq smell lexicon (Wnuk and Majid, 2014:130). In a third and final experiment, eight Maniq speakers rated each of the 15 smell terms on 6 factors: pleasantness, edibility, familiarity, dangerousness, cosmetic value and intensity. The findings of this study are consistent with previous findings regarding the primacy of pleasantness in odour perception (e.g. Khan et al., 2007): using the data yielded by the second and third experiment, it was found that pleasantness was the primary dimension according to which a smell term is assessed in Maniq (Wnuk and Majid, 2014:132-133). This study shows that there are a number of abstract smell terms in the Maniq language which cannot be directly translated to English. This is further evidence that the ineffability of odours is not universal.

2.3.4. Cultural significance of smell

Not only is smell an important part of the Jahai and Maniq languages, but it is also of great cultural significance to the speakers of these languages. The Maniq believe that smell is an important characteristic given off by many entities, and often describe these entities in terms of their smell. The Maniq note the changes of odour over time, not only when it comes to food ageing or going rotten, but also when it comes to seasonal changes in vegetation, animal life and weather. A hog badger, for example, is described using a positive smell term during the dry season and a negative smell term during the wet season. Because positive smell terms are often associated with food in the Maniq language, this indicates that during the dry season, the hog badger is suitable for hunting, whereas in the wet season it is not. Thus, talking about smell plays an important role in hunting patterns. Smells and talking about smells also play a role in gathering plants for food, as well as substances for medicinal and ritual use. Phenomena are often spoken about in terms of smell. Dangerous phenomena, such as diseases, thunderstorms or the hot sun, are associated with unpleasant smells, and are combatted by burning certain substances to produce pleasant smells. Plants used as medicine by the Maniq are often have a very strong pleasant odour, reflecting the idea that unpleasant odours indicate or cause disease, and pleasant odours can cure disease. Jewellery made of fragrant medicinal herbs are often worn to protect the wearer from illness. Smells clearly play an important role in Maniq life and culture, which is reflected in the way they speak about smells (Wnuk and Majid, 2014:134).

Similarly to Maniq, olfaction plays an important role in Jahai, not only in the language but in the culture of its speakers. Many religious beliefs involve smells: certain smells such as human dirt and the blood of certain animals offend Karɛy, a deity who lives in the clouds. Karɛy also expresses anger by emitting certain odours (Burenhult and Majid, 2011:21). Unpleasant odours are associated with disease and pleasant odours are associated with medicine in a similar way to Maniq culture (Burenhult and Majid, 2011:21). The Jahai are therefore another example of a group of people for whom smell plays an important role in their language and culture.

2.3.5. We can learn to name odours and flavours

Other evidence that the relationship between language and odours is not intrinsically weak in humans is related to differing abilities in naming odours depending on exposure, experience

and expertise. In short, we can train ourselves to identify and name certain odours. Ayabe-Kanamura, Schicker, Laska, Hudson, Distel, Kobayakawa and Saito (1998) performed a study in which 40 Japanese participants and 44 German participants were compared on their ability to provide accurate labels or descriptors for a set of odours. It was found that the participants named the odours significantly more accurately when they were more typical in their culture. Participants also rated the odours on pleasantness and edibility, and these ratings also differed significantly between the groups according to how typical these odours are for each culture (Ayabe-Kanamura et al., 1998). This suggests that the more you are exposed to an odour and its name, the better you become at naming it.

The findings of another study suggest that expertise and training play a role, albeit a limited one, in a person's ability to name and describe odours and flavours (Croijmans and Majid, 2016). Qualified wine and coffee experts, who are trained to identify and name odours and flavours in these products using sensory lexicons were compared with novices on their ability to name odours and flavours. The experts' performance was significantly better than that of the novices when it came to odours and flavours from their fields of expertise, but this enhanced performance did not extend to those outside of their fields of expertise. This supports the findings of the above study (Ayabe-Kanamura et al., 1998), showing that experience influences the ability to name odours and flavours, and that one can be trained to learn the names of certain odours and flavours.

The lack of a sufficiently extensive and standardised flavour and odour vocabulary in many languages has made it necessary to develop flavour lexicons for use in sensory science and the food and beverage industry. A flavour lexicon can be defined as "a set of words to describe the flavour of a product or commodity" (Drake and Civille, 2002:33) and is often developed with a certain product in mind, and is thus very specific. Within the lexicon the flavours, which are processed by olfactory receptors through retronasal breathing, or aromas are divided into categories. An aroma wheel for honeybush tea, for example, contains aromas like *raisin* and *lemon* in the category *fruity*, and *honey* and *caramel* in the category *sweet-associated* (Du Preez, De Beer, Moelich, Muller and Joubert, 2020:4). These terms and the categories into which they fall are learned by sensory analysts so that they can identify and name them when they smell or taste a product (Drake and Civille, 2002:33). These lexicons do not form part of

the general vocabulary of a language such as English and people have to be trained to recognise and name these smells and flavours.

2.3.6. Language can influence odour perception

The perception of odours can be influenced by language. That was already touched on above: experts in certain food products are trained to use specific labels to refer to certain odours. A way in which language can have a dramatic effect on olfactory perception is through olfactory illusions. In generic terms, an illusion happens when, due to context, a stimulus is perceived in a way that is different to reality (Gregory, 1997). Such illusions may include the smell of garlic which causes a person to think they are smelling pizza (Engen, 1987). However, as can be seen in this example, these "illusions" usually only take place when the two odours involved are closely associated with one another in the world. Garlic is a key ingredient in pizza, so it is not difficult to imagine that the smell of garlic may be mistaken for that of pizza (Engen, 1987). There are, however, a few studies suggesting that labels can cause more dramatic olfactory illusions.

Herz and Von Clef (2001) aimed to test whether the same ambiguous odour, which may be associated with real-life sources which are vastly different, can be perceived differently, depending on the label given to the odour. Eighty participants were required to rate five different odorants according to pleasantness (from "extremely unpleasant" to "extremely pleasant"), familiarity (from "unfamiliar" to "familiar") and intensity (from "weak" to "strong"). They then answered a few questions about the associations they had with the odour. These odorants were all ambiguous, meaning they could be associated with either a positive or negative real-world source or label. While the odorants were being smelled, the investigator told them what they were smelling, thereby assigning a verbal label to the odour. The same experiment was conducted again two weeks later, but this time the alternate labels were used. This means that in the first session, an odorant that was presented with the label *breath mint* (positive) was then labelled *chest medicine* (negative) during the second session (Herz and Von Clef, 2001:384). It was found that participants perceived the odours to be different, depending on the label it was given. The most significant effect was on the odorant I-B acid, which, depending on the label, was perceived to be either Parmesan cheese or vomit. The extent to

which the label influenced olfactory perception differed for the different odours, which was attributed to a difference in strength of associations with the different odours (Herz and Von Clef, 2001:388).

Another study on olfactory illusions supports Herz and Von Clef's (2001) findings. De Araujo, Rolls, Velazco, Margot and Cayeux (2005) investigated this from a neurocognitive perspective, focusing on the influence of verbal labels on the perceived pleasantness of odours. Labelled odorants were rated on their pleasantness by twelve male participants, while their neurocognitive response was also being recorded using fMRI. There were four conditions: a "pleasant" condition in which a specific odorant was labelled *flowers*, and "unpleasant" condition in which a different odorant had the label *burned plastic*, a test condition in which a third odorant was labelled either *body odour* or *cheddar cheese* and a control condition of clean air labelled *air* (De Araujo et al., 2005:677-678). In a within-subjects design, these label conditions were manipulated during a single session. The fMRI data showed activation of different areas of the brain depending on the label given to the test odour, correlating with pleasantness ratings. Therefore, the odour was perceived as more pleasant when labelled *cheddar cheese* than when it was labelled *body odour* (De Araujo et al., 2005:675). These findings support those of Herz and Von Clef (2001): verbal labels can influence the perception of odours.

Yet another study by Djordjevic, Lundstrom, Clément, Boyle, Pouliot and Jones-Gotman (2008:386-393) investigated olfactory illusions brought about by verbal labels, with a few differences in method and scope to the two studies reviewed above. Forty participants were presented with 15 odours, each of which had three possible labels: a positive label (associated with a typically pleasant source), such as *banana bread*, a negative label (associated with a typically unpleasant source), such as *nail polish remover*, and a neutral label, which was a two-digit number such as *forty-six*. These labels were manipulated in a within-subjects design in one session, like in De Araujo et al.'s (2005) study. Participants read a label out loud from a card and then smelled an odour. They rated each odour on its pleasantness, intensity and arousal. This latter characteristic, as explained to the participants, was a measure of the strength of the emotional reaction, whether positive or negative, evoked by the odour, from "very calm" to "very excited" (Djordjevic et al., 2008:387). Overall, perceived pleasantness, intensity and

familiarity were significantly affected by the odour's label. Positive labels elicited higher pleasantness ratings than negative or neutral labels. Participants perceived odours to be most intense when presented with their negative labels. They also perceived odours to be more arousing when they were accompanied by either their positive or negative labels, and thus least arousing when presented with the neutral label (Djordjevic et al., 2008:388-389).

Djordjevic et al. (2008) also performed a second experiment with 30 new participants. They were presented with either water, which is odourless, or an odorant. For the odorants, the labelling conditions were the same as for the first experiment. The water was also labelled similarly, but participants were made aware of when they were sniffing an odourless stimulus. While they sniffed the stimuli, the participants' heart rate, skin conduction and sniff frequency and intensity were measured (Djordjevic et al., 2008:388). Findings show that the skin conductance was greater when odours had positive or negative labels than when the odours had neutral labels. When the stimulus was odourless, skin conductance was less regardless of the label, and therefore the label alone did not evoke the response. Sniffing increased when participants were given a positive label, showing that the expectation of a positive odour increases sniffing intensity and frequency, whereas the expectation of an unpleasant, uncertain or neutral smell leads to more conservative sniffing. The effect of the label on heart rate was insignificant (Djordjevic et al., 2008:392-393). This study supports the findings of the previous two studies on olfactory illusions, and makes a comparison between the effect of labels on the perception of odours and the effect of neutral labels, as well as labelled but odourless stimuli on olfactory perception.

Beyers (2019) also performed a study on the phenomenon of olfactory illusions, with a similar method to that of Herz and Von Clef (2001), using some of the same experimental odorants and labels used by Djordjevic et al. (2008:387), namely eugenol (*dried cloves* or *dentist's office*), 2-heptanone (*banana bread* or *nail polish remover*) and citral (*squeezed lemons* or *insect repellent*). In a within-subjects research design, 28 native English speakers were given a series of odorants. As they sniffed each odorant, the investigator said the name of the odour. The aforementioned experimental odours were presented twice, each time with a different label, interspersed with distractor odours to ensure that participants did not realise they were being given some of the odorants twice under different labels. Like in Herz and Von Clef's

(2001) study, the participants had to rate each odour according to perceived pleasantness, intensity and familiarity, and they also had to provide memories, actions and names they associated with each odour.

The findings of this study were somewhat similar to those of Herz and Von Clef (2001), De Araujo et al. (2005) and Djordjevic et al. (2008). Labels were shown to influence the perceived pleasantness, intensity and familiarity of the experimental odours to some extent, although significant effects were limited to pleasantness ratings. This makes sense because of the two labels given to each of the experimental odours, one was deemed as "pleasant" and the other "unpleasant". This hedonic factor is commonly used for categorising odours. Labels were found to have a greater effect on the memory, action and name associations than they did on the ratings (Beyers, 2019:26-27). This was attributed to the differing cognitive levels at which hedonic judgements and memory associations are processed. Hedonic judgements form part of lower-level cognition, whereas episodic memory forms part of higher-level cognition. Since language also forms part of higher-level cognition, this suggests that it may exert a greater influence on memory and associations than it would on hedonic judgements (Beyers, 2019:28-29). Research therefore shows that labels can influence the perception of odours to the extent that they may alter what an ambiguous odour is perceived to be, with regard to hedonic factors like pleasantness, as well as associations with odour.

2.4. The chemosenses and emotional language

Considering all the findings reviewed up to this point, a question arises: is the connection between the chemosenses and emotions reflected in language? According to salient research, the answer to this question is yes. The following section gives an overview of findings regarding the embodiment of valence as expressed in language using metaphors. Subsequently, findings regarding the metaphoric relationship between taste and smell words and basic emotions are discussed. Findings regarding the emotional valence and flexibility of smell and taste words in general are also highlighted. Finally, recent findings regarding the relationship between odours and sounds in language are discussed.

2.4.1. The embodiment of valence in language

Experiences of emotional valence has been shown to be captured in language through metaphors (Lakoff and Johnson, 1980). In English, these metaphors are primarily spatial, such as when we refer to someone who is feeling sad as *feeling down*, or telling them to be happy by saying, *lighten up*. These metaphors reflect the way our bodies are structured and the way in which we interact with the physical world. They can therefore be referred to as 'embodied', according to the embodied cognition approach to the study of the mind. Embodied cognition will be further discussed in the next chapter, the Theoretical Framework, but the core idea of this framework is that the way in which an organism thinks is structured according to its physical form and the way in which this form interacts with the environment (Wilson, 2002:625). This is mirrored in language, such as in the aforementioned metaphors (Lakoff and Johnson, 1980). Aside from these metaphors, there are various studies providing evidence for the embodiment of conceptions and judgements of valence.

Several studies have investigated the embodiment of emotional valence in the vertical dimension. A study by Meier and Robinson (2004) found a relationship between emotion and vertical position. English speakers evaluated words on their emotional valence. These words were presented in different vertical positions on a screen. It was found that participants evaluated the positive words faster and more accurately when they were presented at the top of the screen. The same was found for negative words which were presented at the bottom of the screen. These findings support the embodiment of judgements of valence, which are consistent with metaphors that speak about emotion in the vertical dimension.

Wapner, Werner and Krus (1957) conducted a study in which participants drew a line through a square after they had written an examination. It was found that participants who received a low score, and were therefore likely to feel negative after the examination, tended to draw the line with a downward bias. Participants who achieved a high score, and were therefore likely to feel positive after the examination, were more likely to draw the line with an upward bias. This suggests that emotional state influences vertical movement in a way that is consistent with the emotion metaphors highlighted by Lakoff and Johnson (1980).

A study by Dudschig, de la Vega and Kaup (2015) further investigated the influence of valence evaluations on vertical movement. The participants, who were native German speakers, were shown a series of words in different colours of text asked to evaluate whether a word was positive or negative. Subsequently, they had to press different buttons depending on the colour of the text. Pressing the buttons resulted either in an upwards or downwards movement. It was found that the upwards movements were executed faster when positive words were being evaluated. Similarly, downwards movements were executed faster when the word being evaluated was negative.

A subsequent experiment was performed, in which participants responded to word colour using upwards and downwards movements, as in the first experiment, but they were not asked to evaluate the valence of the words. The results showed that the effect of word valence on movement reaction time disappeared when participants were no longer explicitly required to evaluate valence. However, the participants did respond faster when the movement direction was congruent with the spatial meaning associated with certain words. An upwards motion was executed faster when the word *branch* was displayed on the screen, for example. Similarly, a downwards motion was executed faster when the word *stone*, for example, was displayed. A branch usually exists in the upper part of the visual field, whereas a stone is associated with the lower part of the visual field. Similarly, a further finding of this study was that valence words associated with a certain posture, such as *proud* (associated with an upright posture) and *melancholy* (associated with a slouched posture) influenced the speed of participants' responses. Words associated with an upright posture yielded faster upwards responses, whereas words associated with a downwards posture yielded faster downwards responses. Overall, this study provides evidence for the relationship of valenced language and vertical movement.

Vertical movement has also been shown to play a role in the retrieval of positive and negative memories. Casasanto and Dijkstra (2010) performed a study in which participants were required to recall either positive or negative memories while moving marbles either upward, from a lower container to a higher container, or downward, from a higher container to a lower container. The results showed that positive memories were retrieved faster when participants were moving the marbles up, and negative memories were retrieved faster when the marbles

were being moved downwards. In a second experiment, the participants were given neutral memory prompts while performing the marble moving task. It was found that during upward movement, it was more likely for participants to recount positive memories. Similarly, negative memories were more likely to be retrieved during downward movement. This shows that physical vertical movement can influence the valence of the memories people retrieve.

Koch, Glawe and Holt (2011) performed a subsequent study on the effect found by Casasanto and Dijkstra (2010) and extended their focus to include the horizontal axis in addition to the vertical axis. The participants were all native German speakers and were presented with German words that were associated either with upwards movement, such as the word *Wolke* (which means 'cloud'), and words associated with downwards movement, such as *Kerker* (which means 'dungeon'). The words were presented in either purple or turquoise text. Participants were asked to move a slider-like device vertically towards the section of the screen which was the same colour as the text. This effect was also tested on horizontal movement, using a similar task which required participants to move the slider horizontally instead of vertically. Words associated with forwards and backwards movements were also included in this task, such as *Fortschritt* (which means 'progress' and is associated with forward movement) and *Rückzug* (which means 'retreat' and is associated with backwards movement). Both tasks showed increased reaction times when the direction of movement was congruent with the directionality associated with the word. For example, a trial containing the word *Fortschritt* in turquoise when the turquoise part of the screen was in the front, yielded a faster response time than a similar trial in which the turquoise part was at the back. This shows that there is a relationship between word meaning and movement direction in both the vertical and horizontal dimension.

It has been shown that posture affects emotional state and judgements of valence. Riskind and Gotay (1982) performed a series of experiments in which participants' postures were manipulated. In the first experiment, participants were made to adopt either a slumped posture or an expansive, open posture. They were then asked to solve four geometric puzzles, two of which had no solution, followed by a questionnaire to evaluate their current emotional state. It was found that participants who had a slumped posture were less likely to exhibit persistence in the puzzles. A subsequent experiment asked participants to judge the emotional state of

people depicted in images. These people were either in a slumped or upright position. Those who were depicted in a slumped posture were perceived to be more helpless and depressed, than those depicted in an upright posture. This shows that there is an association between posture and emotional state. Finally, Riskind and Gotay (1982:286-291) performed an experiment in which the participants' posture was manipulated to be either tensed or relaxed. They were then presented with instructions for a spatial thinking task, which an experimenter presented as either highly correlated with general intelligence, or not correlated with general intelligence at all. This was to manipulate the threat level of the task, and hence the stress level of the participant. The participants then completed a questionnaire to assess their current stress levels, followed by the spatial thinking task. It was found that participants who were in a tense posture reported feeling more stressed than those who were in a relaxed posture. This study therefore provides evidence for an association between emotional state and body posture.

Hence, it has been shown that emotional valence is captured in linguistic patterns which reflect perceptual experience of space. If emotional valence is embodied in language when it comes to movement, particularly in the vertical dimension, then perhaps other aspects of emotional language, such as its relationship with the senses of taste and smell, may also be embodied.

2.4.2. Metaphor, taste and emotion

Zhou and Tse (2020) investigated the relationship between words associated with taste and emotionally laden words in connection with metaphor. One hundred and two native Cantonese speakers were given a list of one-word concepts such as *difficulty*, one by one, and they were required to come up with a taste word they associated with that concept. Each of the concepts were translated from an English list that had already been normed for emotional valence (Bradley and Lang, 1999). It was found that bitter was associated most often with negative emotion words. When it came to positive emotion words, sweet was the most common taste association. In another experiment, 105 native Cantonese speakers participated in a similar task, except this time they were presented with the five common tastes, namely sour, sweet, bitter, spicy and salty. These tastes represent the most common responses in the first experiment. They had to provide an emotion that they associated with this taste. The results

supported those of the first experiment in that some of the same words were associated with each other in both experiments.

In a third experiment, 120 native Cantonese speakers were given 13 emotion words (*anger, fear, disgust, happiness, sadness, surprise, anxiety, love, depression, contempt, pride, shame,* and *envy*) (Nummenmaa, Glerean, Hari and Hietanen, 2014), paired with each of the five common tastes. They had to rate how strong the association between each taste and each emotion was for them. The results of this experiment supported those of the second experiment. In a fourth and final experiment,30 participants were shown an emotion word or emotion-laden word and were required to rate, on a six-point scale, the strength of their association of that word with each of the five common tastes. The results of this experiment were, once again, generally consistent with those of the previous experiments: negative emotion and emotion-laden words were associated most strongly with bitterness, as well as sourness and spiciness. Positive emotion and emotion-laden words were associated most strongly with sweetness.

This study shows that there is a consistent association between certain tastes and emotions. This association goes both ways; that is, taste is associated with emotion, and emotion is associated with taste. Zhou and Tse (2020:11) argue that these associations are based in metaphor. Conceptual Metaphor Theory (Lakoff and Johnson, 1980) states that abstract concepts are associated with more concrete sensory experiences so that they can be understood. However, this does not go both ways. That is, we do not refer to concrete sensory experiences with metaphoric reference to abstract concepts. Zhou and Tse's (2020) study suggests otherwise, and their study is not alone in providing evidence for concrete-to-abstract metaphoric associations (see, for example, Meier and Robinson, 2004; Huang, Tse and Xie, 2018). Therefore, gustation is connected to emotional language through metaphor.

A similar study was performed with English participants by Chan, Tong, Tan and Koh (2013) to investigate the associations between the emotions of love and jealousy with sweet, sour and bitter tastes. Thirty-seven native English speakers rated the strength of their associations between five basic tastes, namely sweet, sour, spicy and bitter, with five emotions, namely passion, jealousy, love, betrayal and sadness. The results revealed a strong association between

love and sweetness, as well as a strong association between jealousy and sourness and bitterness (Chan et al., 2013:1143). In order to test that these results did not come about because the participants were explicitly given the taste words, a second survey was done. One hundred and two native English speakers were presented with each of the five emotions from the previous survey and asked to produce at least two tastes that they associated with each emotion. The results of this survey supported those of the previous survey: love was most strongly associated with sweetness, and jealousy with sourness and bitterness.

Further experiments were conducted to determine whether the reported associations between tastes and emotions influence the perception of tastes. One hundred and ninety-seven native English speakers were asked to recall and write about three things: an experience involving romantic love (love condition), an experience involving romantic jealousy (jealousy condition) or Singaporean landmarks (neutral condition). After this, they rated their current feelings of a variety of emotions, among them love, jealousy and happiness. Finally, they tasted either a sweet-sour candy or a bitter-sweet chocolate, which they rated on how much it tasted sweet, sour, salty, bitter and spicy. The results showed a significant effect of emotion on the perceived sweetness of the tastants, but the effect of emotion on perceived sourness or bitterness was not significant (Chan et al., 2013:1144-1145). Chan et al. (2013:1146) admit that the fact that the tastants were in the form of candy might have primed participants to focus on the sweet taste. To eliminate this possible effect, they conducted a similar study to the previous one, but replaced the tastants for all conditions with distilled water. The results were consistent with those of the previous experiment: participants in the love condition rated the water as significantly sweeter than participants in the other conditions. There was no significant effect of emotion on the bitterness and sourness ratings (Chan et al., 2013:1146-1147). This study shows that although there is a metaphorical association between love and sweetness, and jealousy and bitterness and sourness, this association is not entirely reflected in actual taste perception, specifically when it comes to the jealousy-sourness and jealousy-bitterness associations.

2.4.3. The emotional valence and flexibility of taste and smell words

It has been shown that, in comparison to words associated with vision, audition and somasensation, words associated with the chemosenses tend to have a higher emotional valence (Winter, 2016:975-988). That is, they are more strongly associated with emotions, either positive or negative. Additionally, they appear in more emotionally laden phrases than words associated with the other senses. These findings are of an analysis of existing lists of adjectives and nouns normed according to sensory modality (Van Dantzig et al., 2011; Lynott and Connell, 2009, 2013), as well as a list of verbs similarly normed by Winter (2016) for the purposes of this study. Existing valence norming data was also used (Mohammed, 2012; Warriner et al., 2013). Fifty-five native English speakers rated 423 adjectives on their perceived association with each of the five senses (sight, hearing, touch, taste and smell) (Lynott and Connell, 2009). Additionally, 34 native English speakers rated 400 nouns on their association with the five senses (Lynott and Connell, 2013). Finally, 72 native English speakers similarly normed 300 verbs according to sensory modality (Winter, 2016:978). When it came to emotional valence, two sets of data were used. The first was a set of 13 915 words which were rated according to emotional valence, using a scale on which 1 was equivalent to "unhappy, annoyed, unsatisfied, melancholic, despaired, bored"), and 9 was equivalent to "happy, pleased, satisfied, contented, hopeful". The second was a set of 54 129 words, normed according to the positivity or negativity of the word they co-occurred with in tweets (Mohammad, 2012).

First, these datasets were combined so that the words that had been normed for modality now also had associated valence norms. Then a corpus study was done using the Corpus of Contemporary American English (COCA) (Davies, 2008). Adjective-noun pairs were searched and analysed according to the valence and modality norms. Finally, the nouns that co-occurred with each of the adjectives were analysed to determine their variation in valence.

It was found that overall, taste and smell adjectives are more highly valenced than adjectives associated primarily with the other senses (Winter, 2016:979). Olfaction and gustation are largely regarded together in the present thesis, even though they differ in many ways. Differences have also been found in the valence of the words associated with each of these senses. The results of this study show that words associated with taste tend to be strongly

positive, whereas very negative words tend to be associated with smell (Winter, 2016:979). It was also found that taste and smell adjectives are more likely to co-occur with nouns that have a high emotional valence, and thus occur in highly emotional phrases (Winter, 2016:980). Furthermore, it was found that words associated with the chemosenses are also emotionally flexible in that the same taste or smell word appears in both positive and negative phrases (Winter, 2016:981). Therefore, this study shows that there is a relationship between taste and smell words and emotional language.

2.4.4. Disgust sounds and odour valence

Speed, Atkinson, Wnuk and Majid (2021) claim that there is a link between odours and language, specifically unpleasant odours and sounds associated with disgust, through emotion. Thirty-three participants were required to smell a series of odours, one by one. After each one, they listened to two pseudowords. One of these pseudowords contained a disgust sound ([f], [x], [ŋ] or [ʔ]) and the other did not. They then chose which word was best suited to the odour. After they had matched a pseudoword to each odour, they then smelled each odour again and rated it according to perceived pleasantness and edibility (Speed et al., 2021:4-5). It was found that the odours that were rated as more pleasant were more likely to be associated with the control words (the pseudowords that did not contain any disgust sounds) than the disgust words. An almost identical follow-up experiment was done with slightly different materials to address some shortcomings of the first experiment. Odours that had stronger positive and negative pleasantness ratings in previous research replaced those that were rated more neutral in the first experiment, and the pseudowords were also altered so that the only difference between the disgust words and the control words was the presence (or absence) of the disgust sounds. This modified experiment yielded the same findings as the first experiment (Speed et al., 2021:6-8). Therefore, unpleasant odours are associated with disgust sounds in words, suggesting that the hedonic quality of odours may connect them with language using sounds that express this hedonic quality.

2.5. Conclusion

It is clear that the role of the chemosenses in human perception and language has been underestimated. These senses are not only more effective in humans than previously thought, but also contribute to survival in a way that is often overlooked. It has been shown that smell and taste is closely linked to the emotions. Odours can evoke vivid and emotional memories and smells and tastes can trigger biological reward mechanisms. Chemosensory stimuli are most often evaluated emotionally, on a hedonic scale. Perceiving certain chemosensory stimuli can influence emotional states and, conversely, the perception of these stimuli can be influenced by the emotional state of the perceiver. When it comes to the relationship between the chemosenses and language, the traditional view has been that this relationship is weak. However, studies on languages like Jahai and Maniq show that this is not the case in every language. Furthermore, it is possible for people to train themselves to name odours. This shows that odours and flavours are not as ineffable as previously thought. Additionally, studies show that labels can influence odour perception, contributing to the notion that the relationship between language and the chemosenses is stronger than previously thought. Regarding emotional valence, it has been shown that emotional valence is captured in linguistic patterns which reflect perceptual experience of space. This shows that experiences of emotional valence and their description in language are, at least to some extent, connected to the way in which our bodies interact with the world. Winter (2016) found that language related to the chemosenses is not only more emotionally valenced, but also more emotionally flexible than languages associated with the other senses. This shows that the link between the emotions and chemosensory perception is reflected in patterns of language use. There are also metaphorical and auditory links between the senses and emotional language.

The studies reviewed in this chapter involve only a small percentage of all human languages and therefore their findings alone cannot be used to make universal claims about human language, emotion and chemosensory perception. However, they provide a starting point for further investigation into these topics. From this starting point, more research on different languages is required to reach a broader understanding of the relationship between chemosenses and emotional language.

3. Theoretical framework

This chapter is an overview of key theoretical points of departure for the current thesis. First, the five senses model is described and its use as a framework to talk about the senses in this thesis is justified. Subsequently, the framework of embodied cognition is discussed. This includes a discussion of the standard cognitive science approach and its relationship with embodied cognition approaches, as well as a summary of some major claims made in salient literature on embodiment. Then, the Embodied Lexicon Hypothesis (Winter, 2019) is described in terms of its claims and its position regarding embodiment. Finally, emotional valence is defined for the purposes of this thesis.

3.1. The five senses model

The human sensory experience is complex. Each moment we are bombarded by a myriad of sensory inputs which we perceive through various sensory organs and mechanisms. Winter (2019:12) defines a sense or sensory modality as "a subtype of perceptual experience that is associated with a dedicated sensory organ and its own cognitive machinery in the brain". According to what Winter (2019:12) refers to as the five senses folk model, there are five senses: sight, hearing, touch, taste and smell. These are each associated with specific sensory organs: the eyes, the ears, the skin, the tongue and the nose respectively. These are, in turn, associated with certain areas in the brain and certain cognitive mechanisms. This is a model traditionally accepted as self-evident in most Western and some non-Western cultures, to the extent that its use in the everyday and in research is not always critically examined.

There are however two main problems with the five senses model (Winter, 2019:13). First, there is the problem of crossmodal interactions. Very rarely do we experience a perceivable entity through only one sense – for example, we cannot taste something without putting it in contact with the skin of our tongues and thereby feeling its texture. The senses of smell and taste are particularly intertwined. Taste sensations happen when tastants come into contact and react with the taste buds on the tongue. However, food also contains odorants which stimulate odour receptors at the back and top of the throat. It is through this combination of taste and

smell that we perceive flavour (see Auvray and Spence, 2008; Spence, Smith and Auvray, 2015). Once one has considered the sheer complexity of human sensory experience, it is difficult to conceive of a model that captures it in its entirety.

Adding to this problem, empirical research has raised many questions regarding the definition of the senses. There is no universally agreed-upon definition, and there are many different criteria one could use to define and distinguish the senses (Winter, 2019:14). We could classify them according to the sensory organ and neural apparatus through which it is experienced, like in Winter's (2019:12) definition given above. However, this is problematic partially because the concept "organ" is difficult to define. Furthermore, if we try to classify senses according to the type of stimulus – light for the visual sense, sound waves for the auditory sense, and chemicals for smell and taste – we run into problems when we consider the complexity of the stimuli which make up the human sensory experience. Thus, we fall into a definitional downward spiral, in which the criteria themselves are unclear (Winter, 2019:14-15).

Secondly, there is the problem of cultural difference. Just as there is no universally agreed-upon definition of the senses, so there is no agreed-upon model of the senses. Considering the aforementioned complexity of the human experience, it makes sense that the five senses is not the only model that exists. Different cultures approach and speak about the senses in different ways (Classen, 1997:402). Some differences in models are not cultural. Findings in the fields of neurophysiology and perceptual psychology do not support the five senses model. For example, within the five senses model, pain falls under the sense of touch. However, some researchers recognise pain, or nociception, as a sense in its own right (Tracey, 2005), such as when it is studied in connection with emotion (Craig, 2003).

Despite all the problems with the five senses model, it still proves useful enough for the current study. There are so many conflicting ideas and criteria by which we can define the senses that it becomes difficult – perhaps even impossible – to study or even talk about senses without simply choosing a model and committing to it. Generally, the five senses model is the one that researchers tend to choose. It is a common agreement that allows for different studies to be compatible and comparable. For practical purposes, it makes sense to use this model when

studying sensory linguistics, while noting its shortcomings (Winter, 2019:16). Furthermore, if one were to try and tease the most accurate and representative possible model of the senses out of the messy tangle that is human sensory experience – if this is even possible – one might never get to other research, such as the current study. In this case, simplification is necessary for findings to be made (Winter, 2019:15). Finally, this model is useful for this study specifically because of the linguistic and cultural setting in which it takes place. Similarly to Winter (2016; 2019), who studied English sensory words, the current study is on Afrikaans, a language in which the senses are spoken about using the five senses model (to the best of our knowledge). Tasks in this study require Afrikaans speakers to think about and classify words according to different sensory modalities, and therefore it would be impractical to use any model other than the one with which they are familiar.

3.2. Embodied cognition

The relationship between the body and the mind has been debated for millennia, and all manner of hypotheses have been put forth. These range from a complete disconnect between the mind and body to such a deep connection that cognition becomes indistinguishable from the body. This relationship will be discussed in the present thesis in terms of the framework of embodiment, or embodied cognition. The framework of embodied cognition encompasses a variety of different ideas and claims, some of which are compatible, some of which are contradictory, and all of which require some form of clarification and interrogation. Accordingly, there has been some debate over the details. Because of this, embodied cognition is seen as a particular approach to research rather than a concrete theory (Shapiro, 2011:2). A common thread that runs through the literature is the idea that there is a connection between "low level" perception and "high-level" cognition (Winter, 2019:71). According to Willems and Francken (2012:1), "embodied cognition stresses that perception and action are directly relevant for our thinking". This is in opposition to standard approaches to cognition, which claim that cognition occurs in the brain only.

3.2.3. Standard cognitive science: Disembodiment

Before delving into the claims of the embodied cognition framework, which rest upon the idea that sensory perception plays a significant role in cognition, it is necessary to explore the idea that there is a barrier between perception and cognition. A common assumption made by early cognitive psychologists was that perception is inherently flawed (Marr, 1982; Rock, 1985). That is, perceptual processes are insufficient to grant our minds full access to the empirical world and can therefore not be relied upon to perform tasks and solve problems. From this view, the following question arises: how, then, do we perform tasks and solve problems? The answer is that the brain stores information which is accessed and implemented to the best of the brain's ability, according to a combination of knowledge gained through sensory input and internal knowledge stored in the brain (Wilson and Golonka, 2013:2). According to this view, cognitive processes happen algorithmically and are based on symbolic representations of information. These processes are linear: the brain receives input, processes it, and produces an output (Shapiro, 2011:27). Standard cognitive science therefore strives to determine the nature, access and use of this knowledge (Dietrich and Markman, 2003). Cognitive science therefore needs not concern itself with processes that happen outside of the brain (Shapiro, 2011:49).

However, proponents of embodied cognition argue that it is not fair to assume perception is flawed; it should be considered a resource rather than a hindrance to cognition (Wilson and Golonka, 2013:2). Embodied cognition therefore seems to stand in stark opposition to standard approaches to cognitive science. One argument against the idea that cognitive processes happen only inside the brain and do not involve perception and action, is that an organism can uncover characteristics of an environment by exploring and acting upon it. This suggests that the brain does not simply make inferences about an environment based on flawed information gained through perceptual processes, but "is better conceived as a controller and organizer of activities that result in the extraction of information than as a computer for processing this information" (Shapiro, 2011:49). Cognitive processes are therefore, according to this view, not confined to the brain.

3.2.4. Embodied cognition vs standard cognitive science

Shapiro (2011) untangles the nature of embodied cognition in comparison to standard approaches to cognitive science in an attempt to determine the extent to which they stand in opposition to one another, and whether standard cognitive science approaches can be abandoned in favour of embodied approaches. He identifies three themes of embodiment: Conceptualisation, Replacement and Constitution.

Conceptualisation is the idea that "the properties of an organism's body limit or constrain the concepts an organism can acquire" (Shapiro, 2011:4). In other words, organisms experience and think about the world differently according to the nature of their bodies. According to Varela, Thompson and Rosch (1993), an organism builds its own world, the characteristics of which depend on the nature of the organism's body. Therefore, an objective world is non-existent. However, Shapiro (2011:112) brings this idea into question by highlighting the triviality of much of the empirical evidence used to support it. Furthermore, proponents of Conceptualisation assume that the explanations given by standard cognitive science for phenomena they attribute to Conceptualisation are inadequate, and that these inadequacies lie in the nature of the computational framework itself rather than in its details, which could easily be adapted based on new evidence. However, Conceptualisation cannot be entirely refuted, as there is a possibility that new evidence may arise to prove that an organism's acquirable concepts do depend on the nature of their bodies in some way (Shapiro, 2011:113).

Replacement is the idea that cognition can take place without the symbolic representations proposed by standard cognitive science approaches, as they are replaced by the interaction between the body and the world. Shapiro (2011:157) argues that there is insufficient evidence for the complete replacement of standard cognitive science explanations for cognitive phenomena with embodied ones. However, embodied explanations may complement standard cognitive science in some respects.

Constitution is the idea that the body and the environment form part of cognitive processes, rather than simply causing them. Shapiro (2011:199) argues that when dealing with

Constitution theories, clarification is extremely important. Many critics try to refute these theories by showing that brain-external processes lack cognitive characteristics, but these arguments are circular. Of course a brain-external process is going to lack the characteristics of a brain-internal cognitive process, but that does not necessarily mean it is not cognitive. All that matters is that the system as a whole is considered to be cognitive, which it is. According to Shapiro, Constitution does not stand in opposition to standard cognitive science, but in most cases it attempts to expand the boundaries of standard cognitive science (Shapiro, 2011:199).

3.2.5. Different views on embodiment

As mentioned previously, literature on embodied cognition contains a variety of viewpoints and definitions. Although most approaches agree that the body – sensorimotor processes and perception – plays a role in cognitive processes, there are some differences in understanding of how this actually works. Grounded cognition, situated cognition, distributed cognition, extended cognition and dynamical systems approaches to cognition all overlap with the embodied cognition framework in one way or another (Winter, 2019:71; Spivey, 2007; Wilson and Golonka, 2013). Wilson (2002) identifies and evaluates certain claims commonly brought up in the literature on embodied cognition.

3.2.5.1. Situated cognition

Firstly, theories of embodied cognition often claim or assume that cognition is situated - that it "takes place in the context of relevant inputs and outputs" (Wilson, 2002:626). The cognitive process, according to this view, involves and input of information about the situation and task at hand from the sensorimotor system – the body – informing movement to execute the task at hand. This is also known as on-line cognition and includes activities such as riding a bicycle or cooking. However, this view does not account for the embodiment of nonsituated or off-line cognition, which is cognitive activity not related to the immediate task at hand (Clark and Grush, 1999; Grush, 1997). This includes activities such as planning for the future, remembering, and daydreaming. It is clear that humans are capable of both types of cognition, and that our nonsituated cognition has evolutionarily set us apart from other species. Therefore,

according to this view, cognition is partially embodied, and that embodiment is limited to on-line cognitive activity (Wilson, 2002:626).

3.2.5.2. Time-pressured cognition

The second of these claims expands upon the idea of situated cognition by including time. Particular situations take place in a particular time, most often out of the cognisor's control, and therefore cognitive activities are bound by time. In the real world, cognisors are often under pressure to process and respond to a changing situation in real time (Wilson, 2002:627). This leads to a "representational bottleneck" – there is no time to internalise every detail of the entire environment, so the cognisor is forced to focus on those elements that are most relevant to the task at hand (Wilson, 2002:628). For example, when one is navigating a busy sidewalk, the time pressure causes us to prioritise the speed of an oncoming pedestrian over the colour of their shirt, or the sound of the car driving past in the road two metres away. The view that cognition is time pressured assumes that humans are good at handling this representational bottleneck. However, this is not the case. While for the purpose of survival and interaction with the world we must deal with time-sensitive situations, our cognitive power is not at its highest during these times. Our lives do not solely consist of high pressure, time sensitive situations and activities. Quite often, we are given the opportunity to step back (sometimes literally) from a situation so we can get a fuller picture, take the time to plan, and then, only when we are ready, step back in and take action. If we are able, we tend to take ourselves offline in this way, to participate in offline cognitive activities.

However, some activities do involve real-time interaction with the environment. For example, activities that require perceptuomotor coordination, from something as simple as walking or reaching to grasp a mug of coffee, to skilled hand movements such as knitting or playing the piano. There are situations that change so rapidly and unpredictably that they require us to continuously make and update decisions from moment to moment – navigating a busy sidewalk, for example. It is therefore clear that humans are able to execute cognitive activities under time pressure, but placing too much emphasis on this kind of activity does not result in a sufficiently complete theory of human cognition and the embodiment thereof.

3.2.5.3. Cognitive off-loading

Since we do seem to be able to deal with the representational bottleneck to some extent, the question is: how? One way is by relying on previous experience of the world, which can help us with current tasks. Another way is by strategically using the environment to off-load some cognitive work. We can do this by altering the environment to make a task easier for ourselves, and thereby making the environment do some of the work for us. A birthday calendar, for example, is a way to record information in the environment to save us from the effort of having to remember birthdays (Wilson, 2002:628).

However, of more interest to the theory of embodiment is other strategies people use to solve problems, such as the way an interior designer may walk around a room to help decide on a furniture arrangement or laying out the parts of a toy one needs to assemble in more or less the way they would have to be put together. These tasks involve a sort of spatial off-loading, in which objects (or the self) is moved within the environment to make the task easier to complete. Glenberg and Robertson (1999) showed that when participants could make a connection between items in their surroundings and written instructions, they performed better in a compass-and-map task than participants who were not allowed to make such connections. However, there are many tasks that do not involve spatial information at all, and it seems that cognitive off-loading applies to these tasks as well. Mathematics is not inherently spatial, and yet we can bring it into the spatial dimension by counting on our fingers or using a pencil and paper to do complicated calculations. In that way, nonsituated tasks become situated. The task of writing is situated – it involves physical interaction with the environment. However, this situated task is in service of a nonsituated task, a cognitive activity that has nothing to do with the immediate environment. "Rather than attempt to mentally store and manipulate all the relevant details about a situation, we physically store and manipulate those details out in the world, in the very situation itself" (Wilson, 2002:629). Wilson (2002:629) calls this kind of off-loading "symbolic off-loading", which can be applied to both spatial and nonspatial tasks. In this way, even nonsituated cognitive tasks can become situated and embodied if they are off-loaded onto the environment.

3.2.5.4. Distributed cognition

The fourth claim is that the environment is part of the cognitive system, that "[t]he forces that drive cognitive activity do not reside solely in the head of the individual, but instead are distributed across the individual and the situation as they interact." (Wilson, 2002:630). The claim therefore is that cognitive activity is the activity of a single system that consists of the mind, body and environment. It is in this second part of the claim that we run into some problems. Just because the mind, body and environment all cause behaviour, it does not mean they constitute a system. Here we must examine what we consider to be a system. A system is, in simple terms, a set of things that are not only related to one another in some way (whether that is in space, time, or otherwise), but that are affected in some way by being part of this system. Since technically all elements in the universe have some sort of effect on some other elements, one could say that there is no system smaller than the entire universe. It is therefore useful to distinguish between open and closed systems. An open system is affected by the environment, but for the sake of practicality and applicability to study, the environment is not considered part of the system. How one decides which elements are part of a system and which are not – "how best to carve nature at its joints" (Wilson, 2002:630) – is ultimately a product of the aim of the study.

Given this, how do we carve out what is part of the cognitive system, and what is not? The answer lies in its organization – that is, "the functional relations among its elements" (Wilson, 2002:630). Wilson (2002:630) distinguishes between two kinds of system. The first is a facultative system, which exist temporarily to fulfil a certain function and cease to exist once that function has been fulfilled. In contrast, obligate systems are relatively permanent and usually require the disappearance of its parts for it to cease to exist. When we consider what might constitute a cognitive system in terms of organization, it becomes quite clear that it is not viable to consider the human cognitive system to be distributed across mind, body and environment. Because the environment in which cognitive activity takes place is constantly changing – a person can move from one room to another or stop playing the piano to go and pet the cat on the other side of the room – a distributed system must be facultative. Every time there is a significant change in environment, the system is disbanded and a new facultative system must be formed. According to Wilson (2002:630), this makes it very difficult to study

this system and draw any useful conclusions about its characteristics and functioning. Then, it is more useful to view the cognitive system as an open obligate one, consisting of the mind only, which allows us to discover underlying characteristics and patterns. However, not all scholars agree with this view. Proponents of extended cognition theories (e.g. Clark and Chalmers, 1998; Rowlands, 2009) argue that it is possible to study the mind without necessarily separating it from the environment.

3.2.5.5. Action-driven cognition

The fifth claim is that the ultimate aim of all cognitive activity is action, and that all cognitive mechanisms should be considered "in terms of their function in serving adaptive activity" (Wilson, 2002:631). Perception and memory provide a detailed example of what is meant by this. Traditionally, visual perception has been thought of as a way to construct a mental representation of the world which is being perceived. This mental representation is then used to guide actions, like reaching and grasping. This is supported by evidence that seeing certain things can prime certain movements. Memory, when conceptualised as "the encoding of patterns of possible physical interaction with the three-dimensional world" (Glenberg, 1997:1), is also a cognitive activity that serves action. According to Glenberg (1997), concepts are formed through patterns of memory, which serve action. If concepts are formed in this way, this supports the view that all things are conceptualised in terms of our relationship with them and how we can interact with them. But are there really no cases of "representation for representation's sake" (Wilson, 2002:632) – that is, do we ever perceive something we cannot interact with? The way visual processing works suggests that we do. There is a part of the visual processing system, as far as we can tell, that is not connected to the motor system in a significant way. It appears we use this part to just perceive things, without the possibility of physical interaction with it. We cannot touch or grasp or move a sunset, for example, and yet we do look at it, perceiving just for the sake of perception. When we read, we do not physically interact with the letters on the page, but we do perceive them visually to recognise letters and words, understanding them and thereby gaining knowledge or enjoyment. One might argue that seeing something is interacting with it, but in this context that argument falls flat – perception in itself and action are seen as separate in this case. Therefore, there exists enough evidence for

perception for perception's sake that it cannot be concluded that all perception is in service of physical interaction with the environment.

3.2.5.6. Body-based off-line cognition

The final claim is that off-line cognition is body based. This is the claim that is of most theoretical relevance to the current thesis, and it pulls elements from the previous claims. Under the claim that cognitive activities are offloaded onto the environment, the example of counting on one's fingers was used to illustrate how people may bring nonspatial tasks into the spatial world to help save some cognitive work. Whilst one may hold one's hand up and count in a very obvious way, by touching or extending each finger in turn, this is not always the case. Very often, the only visible indication that someone is counting on their fingers is a twitch – they may not even bring the hand into their field of vision. There might not even be a twitch at all (Wilson, 2002:632-633). The argument under the current claim is that, like this example, much of our cognitive activity takes place in a covert way, even those which seem to be abstract and not related to the body at all. Processes and structures in the mind that are related to perception and interaction with the environment can therefore run in the absence of a physical environment to perceive and interact with. In these cases, the aim is to simulate a physical environment in order to "represent information" or "draw inferences" (Wilson, 2002:633).

Many such simulations are captured in language using metaphors. An example of this is the description of time, which is an abstract concept, using spatial metaphors, which refer to the concrete concept of space. English speakers, for example, speak about a *long* or *short* time, hence speaking about duration in terms of length, and Spanish speakers talk about a *big* or *small* time, hence speaking about duration in terms of size (Bylund and Athanasopoulos, 2017:912). The metaphors allow us to bring off-line cognition, that is thoughts about time, into a body-based, concrete domain.

Mental imagery, various different kinds of memory, and reasoning and problem-solving appear to make use of mental simulations. Perhaps the most obvious evidence of mental simulation is the existence of mental imagery. Whilst mental simulation and mental imagery are not

equivalent, they are similarly involved in body-based off-line cognition. After some debate it has now been commonly accepted that mental images are indeed cognitively analogous to real-world images, they just exist independently of external perceptual input. Working memory, which is the kind of short-term memory that allows us to "store" information for current use in the present situation, seems to also make use of mental simulations (Wilson, 2001). Instead of transferring cognitive load to the physical environment, it appears that this load is transferred to a kind of mental simulation in the mind. Evidence for this include findings that show people are less likely to remember a sequence of hand signs when they are similar to one another or take a longer time to sign, in addition to detrimental effects on memory arising when participants were making repetitive hand movements, thereby preoccupying the physical muscles they seemingly use to mentally simulate signs (Wilson and Emmorey, 1997; Wilson and Emmorey, 1998). Episodic memory, which is a kind of long-term memory focused on past experiences, involves "reliving" these past experiences. Especially when the memories are recent, reliving them includes a mental simulation of physical elements of the event, including visuals and movements through space, as well as interaction with objects. Furthermore, implicit memory, which is where skills which have been learned and are now automatic and more easily used than before they were learned, are stored, also makes use of mental simulations. Once a task has become automatic, its cognitive load is reduced and the system can more easily deal with the representational bottleneck, and need no longer offload as much onto the environment (Epelboim, 1997), or can take on more tasks. Automaticity is facilitated by mental representations based on previous interaction with the physical world. Finally, reasoning and problem-solving have been shown to be supported by mental models, formed using sensorimotor simulations. The examples given above pose a strong argument for offline cognition being based on the body and its interaction with the physical world.

3.3. The Embodied Lexicon Hypothesis

Within the embodied cognition framework and in connection with sensory language, Winter (2019) proposes the Embodied Lexicon Hypothesis (ELH), which, most simply, states that "language mirrors perception" (Winter, 2019:81). Sensory perception shapes language, particularly sensory language, and therefore associations between senses mirror associations in sensory language. Similarly, differences in the senses should result in predictable differences

in language associated with these different senses (Winter, 2019:81). As mentioned above, mental simulations play a significant role in many cognitive processes. Although important to the theory as a whole, Winter's focus in conceptualising and supporting the Embodied Lexicon Hypothesis is on patterns in real language use and how these are also embodied. The same can be said for the focus of the present thesis.

3.3.1. Modal vs amodal view of meaning

The nature of the conceptual systems that underlie meaning in language is a topic of debate. The two main sides of this debate are the modal view of meaning and the amodal view of meaning. According to the modal view of meaning, mental concepts consist of modal mental representations. This means that representations associated with sensorimotor processes make up concepts. The concept of a cupcake, for example, includes the visual representation (or mental image) of a cupcake, as well as the gustatory representations such as a memory of the sweet taste of a cupcake, among other representations associated with a cupcake (Winter, 2019:70). In opposition to this view stand the amodal view of meaning, according to which a word's meaning, or concept associated with a word, is not associated with concrete sensory perceptions but is rather an abstract symbol in the mind. Each concept is made up of a set of abstract features, like a type of dictionary entry. The dictionary entry for the word *sheep*, for example, would include features such as [+quadrupedal] and [+mammal]. According to this amodal view, then, there is a separation between perceptual processes and conceptual representations (Winter, 2019:70). There may be some sort of connection between some abstract concepts and sensorimotor processes (Mahon and Caramazza, 2008), but these connections are not as direct as those proposed by the modal view of meaning. The modal view of meaning is associated with embodied cognition, and as such the ELH, as it has to do with the influence of sensory perception on language, supports the modal view of meaning (Winter, 2019:70).

3.3.2. Strong embodiment vs weak embodiment

Given the varying theories of embodiment, it is important to establish which type of embodiment forms the basis of the ELH. It can be said that all embodiment theories fall on a spectrum that includes "weak embodiment" and "strong embodiment" (Meteyard, Cuadrado, Bahrami and Vigliocco, 2012). According to embodiment theories that fall on the weaker part of the spectrum, sensorimotor systems play a role in constructing meaning and concepts, whereas theories that fall on the stronger end of the spectrum posit that meaning depends entirely on sensorimotor systems (Meteyard et al., 2012:791). According to the distinction between strong and weak embodiment, the ELH is a theory of strong embodiment (Winter, 2019:72). As previously mentioned, one of the claims found in the literature on embodiment is that off-line cognition is body based. That is, elements of off-line cognition are grounded in the body, such as counting on one's fingers, to lighten the cognitive load (Wilson, 2002:632-633). A more subtle version of the example of counting on fingers is the use of mental simulations to bring off-line cognitive activities into a simulated realm of the body's interaction with the physical world. The ELH is in line with this strongly embodied view.

3.3.3. Mental simulation vs mental imagery

Mental simulations and mental images are similar in many ways, but there is a key difference: the latter is conscious, whereas the former is not. According to modal views on meaning and embodied views on cognition, when we use language, whether it be by producing or consuming it, we mentally simulate the meaning of that unit of language. This mental simulation neurally activates the same areas of the brain as when that event is actually being perceived or actions are being performed (Barsalou, 1999; Fischer and Zwaan, 2008; Zwaan, 2009; Bergen, 2012). For example, when someone is talking about walking up a flight of stairs, the same neural activation patterns appear in the brain as when they actually are walking up a flight of stairs.

On the other hand, mental imagery is in essence a conscious version of a mental simulation (Connell and Lynott, 2016). For example, when one is looking for one's car keys, one might consciously visualize the last time they were seen, and then retrace one’s steps since then to

locate the keys. This, similarly to a mental simulation, activates the same neural processes that actually taking those steps would activate. Mental simulation is not only less conscious than mental imagery, but it is also less intentional and less vivid (Connell and Lynott, 2016). For example, when the word "cupcake" is mentioned in conversation, a mental simulation of a cupcake is triggered, but is far less vivid and conscious than when one is specifically instructed to imagine a cupcake. These two concepts are inextricably linked, as mental simulation cannot exist without mental imagery. However, for the purposes of some research, like that presented in this thesis, it is important to distinguish them. The ELH focuses on mental simulation rather than mental imagery, although it acknowledges that the former is not possible without the latter (Winter, 2019:73).

3.3.4. The Embodied Lexicon Hypothesis

The core claim of the ELH is that the way in which we use sensory words is governed in part by the way in which we perceive sensory qualities. Therefore, differences in perception lead to differences in language use, and associations in perception lead to associations in language. Essentially, "language mirrors perception" (Winter, 2019:81). The premises of the ELH are as follows: firstly, "words activate sensory-motor representations" (Winter, 2019:81) and secondly, "those sensory-motor representations partly determine word choice" (Winter, 2019:81). The relationship between words and sensory-motor representations is therefore an interactive one. Therefore, "language comes to reflect sensory-motor processes in its structure, as well as in language use" (Winter, 2019:8). It has already been shown that mental simulations have an effect on word processing (Connell and Lynott, 2012; Spence, Nicholls and Driver, 2001; Turatto, Galfano, Bridgeman and Umiltà, 2004), but the Embodied Lexicon Hypothesis extends this by proposing that linguistic patterns are also affected by mental simulations.

On a trivial level, the ELH is true: we cannot speak about characteristics we cannot perceive, and our sensory vocabularies are therefore shaped and limited by our perceptual mechanisms. However, the ELH deals not only with sensory vocabularies, but patterns in language use as well, patterns which reveal a much deeper connection between perception and language (Winter, 2019:82). Despite this deep connection proposed by the ELH, this hypothesis does not claim that there is an exact correspondence between language and perception. The fact that

it is not always possible to capture sensory characteristics using language is testament to this. Many smells and flavours, especially in many widely spoken and Western languages, are very difficult to name, for example (cf. Majid and Burenhult, 2014; Majid et al., 2018; Wnuk and Majid, 2014). The depth and multisensory nature of our experience of the world is necessarily condensed in language. This is a point of criticism for many theories of embodiment, including the ELH. However, based on findings on English, Winter argues that it is still a sufficient theory for explaining patterns in language use when it comes to sensory words (Winter, 2019:83).

3.3.5. The embodiment of emotional valence

Emotion is a difficult thing to define for universal intents and purposes, although some work has been done to come up with a working definition, which has revealed many of the aspects of emotion (Mulligan and Scherer, 2012:345). Therefore, it is necessary to specify what "emotion" means within the context of this thesis. For the purposes of this thesis, emotion will not be considered in terms of its specific quality (such as sadness, disgust, or surprise), but will be looked at in terms of its position on the spectrum of emotional valence (Winter, 2019:87). Emotional valence, also referred to as just "valence" (Warriner, Kuperman and Brysbaert, 2013:1192) is the affective quality of emotion – that is, whether it is positive or negative. For example, the words *lovely*, *great* and *delicious* are usually used to indicate something good or positive, whereas the words *nasty*, *putrid* and *ugly* are usually used to indicate something bad or negative. Of course, valence is not the only aspect of emotion, but for the purposes of the present thesis it is sufficient to focus on it.

There is evidence for the ELH, particularly when it is applied to the emotional valence of sensory words, in research on the expression of emotional valence in language. A number of studies have shown that linguistic patterns related to valence are embodied. Not only are experiences of emotional valence expressed in language using spatial metaphors such as *feeling down* or *lighten up* (Lakoff and Johnson, 1980: 3-14), but there is also a relationship between vertical body movement and emotional state (Meier and Robinson, 2004; Wapner et al., 1957; Dudschig et al. 2015; Casasanto and Dijkstra, 2010; Koch et al., 2011; Riskind and Gotay, 1982). For a detailed discussion of these findings, see Chapter 2, section 2.4.1.

3.3.6. Language activates perceptual simulations

Several studies provide evidence that perceptual experiences are mentally simulated, and that these simulations are activated by language. Words related to movements, such as *kick* and *push* have been shown to activate areas in the motor cortex of the brain related to the parts of the body that carry out those actions. For example, reading the word *push* activates the area of the brain related to hand movements (Hauk, Johnsrude and Pulvermüller, 2004).

In addition, many studies have shown that language activates visual simulations. For example, in a study by Stanfield and Zwaan (2001), participants have been shown to respond faster to sentence-picture matching tasks when the sentence and the picture are congruent. After reading a sentence such as *He hammered the nail into the floor* participants reacted faster to a picture of a nail in a vertical position, whereas reading a sentence such as *He hammered the nail into the wall* was followed by faster reactions to a nail in a horizontal position. In both examples, the orientation of the nail in the image matched that of the nail in the sentence, showing that reading the sentence activated a visual mental simulation of the actions being described. Connell and Lynott (2009) found similar effects with colour. After reading sentences containing an implication of object colour, such as *Jane tasted the tomato before it was ready to eat* or *Jane ate the tomato when it was ready to eat*, participants completed an altered Stroop task using the word referring to the object, which in this case is *tomato*. It was found that colour naming was facilitated when the text colour matched the colour implied in the sentence, as well as when the text colour matched the typical colour for the object. For example, participants responded faster when, after reading the sentence *Jane ate the tomato when it was ready to eat*, they were presented with the word *tomato* in red text. This shows that reading the sentence activated a visual mental simulation of a ripe, red tomato.

Auditory simulations are also activated by language. In a study by Winter and Bergen (2012) participants read sentences implying that a noise was coming from either nearby or far away. Subsequently they heard the noise, either at a low or high volume. The participants were asked to indicate whether the sound was coming from the source referenced in the sentence. The

results showed that the participants reacted faster to the sound if the distance was congruent with the distance indicated in the sentence. For example, after reading the sentence *As you are petting the cat, it meows*, participants would react faster if the sound played subsequently was loud. On the other hand, participants reacted faster to a quieter sound after reading a sentence such as *A cat meows somewhere in your neighbour's yard meows*. This suggests that a mental simulation of the situation described in the sentence was activated.

Additionally, research shows that language related to touch activates touch-related mental simulations. Lacey, Stilla and Sathian (2012) found that texture-related metaphors activate parts of the somasensory cortex in the brain. The same pattern of activation was not found when participants were presented with sentences with similar meanings, but without touch metaphors. Pain, or nociception, which can be regarded as a separate but related sense to touch, is similarly simulated in the mind when perceiving pain-related language. Richter, Eck, Straube, Miltner and Weiss (2010) compared brain activity when reading pain-related words to that when reading other negative words not related to pain. They found that reading the pain-related words, such as *excruciating,* caused significantly more blood flow to the pain centres in the brain than reading other negative words, such as *disgusting*.

Further evidence for perceptual simulations triggered by language comes from findings on the sense of taste. Barrós-Loscertales, González, Pulvermüller, Ventura-Campos, Bustamant, Costumero, Parcet, and Ávila (2011) presented Spanish-speaking participants with a reading task containing some taste-related words, such as *cerveza* ("beer") and some words not related to taste, such as *piel* ("skin"). It was found that the taste words activated the parts of the brain associated with taste perception to a significantly greater extent than words not related to taste. Citron and Goldberg (2014) found similar activation patterns in the brains of German speakers reading German taste-related metaphors, in comparison to similar sentences not containing such metaphors. They also found that emotion-related areas of the brain were more active while readings the metaphorical sentences, suggesting that not only did the metaphors activate taste simulations, but the emotions as well.

Findings on words related to the sense of smell also support the idea that language activates perceptual simulations. In a study by González, Barrós-Loscertales, Pulvermüller, Meseguer, Sanjuán, Belloch and Ávila (2006), native Spanish speakers read words, some of which were smell-related, such as *ajo* ("garlic") and some of which were not, for example *abrigo* ("coat"). The smell-related words triggered increased brain activity in the regions associated with olfactory perception, suggesting that these words triggered mental simulations of smells.

On the other hand, a more recent study by Speed and Majid (2018) offers some counterevidence to the idea that odour language is embodied. In their first experiment, Dutch-speaking participants were presented with a word, which they were instructed to remember while they heard a sound. They were then asked to recall the word. Subsequently, they indicated whether they recognised the sounds, and then rated the sounds on pleasantness and familiarity. It was found that the participants recalled sound-related words faster when they were followed by a matching sound. For example, participants recalled the word *zee* ("sea") faster when it was followed by the sound of waves than when it was followed by the sound of a car. This suggests that, in line with the findings by Winter and Bergen (2012), language about sounds activates mental simulations of those sounds. However, a second experiment involving olfactory stimuli instead of auditory stimuli did not yield the same findings. This suggests that smell-associated language does not activate mental simulations of smells in the same way that sound-related language activates mental simulations of sounds. Speed and Majid (2018) did, however, find that odour pleasantness and intensity ratings were affected by the smell-related words. This suggests that smell-related language activates mental representations of factors like pleasantness and intensity related to the meaning associated with the smell-related language. Winter (2019:79) argues that these representations fall under those accounted for by the ELH.

Most of the findings reviewed above are evidence that language activates perceptual simulations. This supports the connection between language and perception posited by the ELH. However, the ELH posits an even deeper connection between language and perception. Winter (2019) takes the embodiment of the sensory lexicon one step further, based on findings suggesting that language activates perceptual simulations, which activate, in turn, embodied valence associations with these perceptual simulations (Winter, 2016). In a study on valence and olfactory language, Winter (2016) found that words related to smell and taste are more

emotionally valenced and occur in more emotionally flexible contexts in language use than words related to the other senses. He argues that this is due to the strong hedonic quality of smells and tastes, which we experience through our sensory system and influence the way we use language related to these senses.

3.4. Conclusion

It is clear that the framework of embodied cognition encompasses a wide range of views. At its core, however, it is the view that there is a link between the brain and the body, and that our experience of the world through somasensory processes plays a role in cognitive processes. This contrasts with traditional views on cognition, which claim that cognition is confined to the brain and is therefore not influenced by our physical interaction with the environment. The theoretical basis for the current thesis is the ELH (Winter, 2019). Its core claim is that perceptual experiences influence language use in predictable ways. This is a theory of strong embodiment, as it posits that perceptual experience gained through the body directly influences cognitive activities. The ELH also argues for mental simulations of perceptual experiences which are activated by language, of which there is ample evidence in empirical research.

4. Method

As established in Chapter 1, the aim of the present thesis is to answer the following research questions:

1. In comparison to words associated with other sensory modalities, to what extent are Afrikaans taste and smell words emotionally valenced?
2. In comparison to words associated with other sensory modalities, to what extent do Afrikaans taste and smell words appear in highly emotionally valenced phrases?
3. In comparison to words associated with other sensory modalities, to what extent are Afrikaans taste and smell words emotionally flexible?

In order to answer these questions, a quantitative study was conducted based on Winter's (2019) study, the core of which is a corpus study informed by English norming data collected by Lynott and Connell (2009; 2013) and Warriner, Kuperman and Brysbaert (2013). Prior to the present research project, such valence and modality norms did not exist for Afrikaans. Therefore, this study involves establishing similar norms as well as performing a corpus study and analysis based on them. Given the scope of an MA project, this study necessarily had to be done on a smaller scale than Winter's (2016) study.

4.1. Norming Study 1: Adjective modality and valence

4.1.1. Participants

A total of 78 native Afrikaans speakers over the age of 18 years completed this norming task. Participants who indicated in the language background questionnaire that their first language was not Afrikaans, as well as those who indicated they started learning Afrikaans after the age of 2 years, were excluded from the study. This also applies to Norming Study 2. Of these 78 participants, 68 were female and 10 were male. The age range was 18-79, with a mean age of 34.65 years and a standard deviation of 18.52. Only the data from those who completed the entire survey were included in the analysis. Each participant normed half of the list of 60

adjectives. This was done to make the survey shorter and more manageable for participants, in order to increase the likelihood of participants completing the entire survey. Participants were randomly assigned a list. Group A normed List A, and Group B normed List B.

Group A consisted of 33 participants, of which 4 were male and 29 were female. Their ages ranged from 18 years to 78 years, with a mean age of 37.39 years and a standard deviation of 20.31. Of these 33 participants, 24 indicated that they also spoke English, of which four started learning English before they were two years old. Some participants in this group spoke isiXhosa, Italian, Chinese and/or German, but the participants who spoke these languages did not speak them frequently and were not very proficient.

Group B consisted of 45 participants, of which 6 were male and 39 were female. Their ages ranged from 19 years to 79 years, with a mean age of 32.64 years and a standard deviation of 17.03. Of the 45 participants, 40 indicated that they also spoke English, of which 12 indicated that they started learning English before the age of 2 years. Additional languages spoken by participants in this group were isiXhosa, Dutch, German, French, Korean and South African Sign Language. None of these languages were used very often by the participants who spoke them, nor were they very proficient. Inferential analyses showed that there was no significant difference between the gender distribution of the groups ($\chi 2 = 0.03$, $p = 0.864$) or the age distribution ($t = 1.12$, $p = 0.133$).

4.1.2. Materials

The survey was conducted online using the platform Psytoolkit (Stoet, 2010; Stoet, 2017). The survey consisted of a consent form, a modality norming task and valence norming task, as well as a language background questionnaire.

4.1.2.1. Consent form

The consent form informed participants that participation in the study was voluntary, that they had the right to refuse to answer any of the questions or leave the study at any point without consequences, that their responses would be kept anonymous and confidential. The form also detailed that at the end of the survey they could indicate their willingness to participate in a lucky draw for R200 cash by entering their email address at the end of the survey, and that this email address would not be linked to their responses. The form also made participants aware that the task they were about to complete entailed a series of questions about their associations between different words and the five senses, as well as the emotional value they perceived the words to be, followed by some basic background questions about their age, gender and language background.

4.1.2.2. Adjective list

The list of Afrikaans adjectives used in this survey was compiled using a variety of approaches in similar method to Lynott and Connell (2009:559). This included online dictionary and thesaurus searches through PharosOnline (Pharos, 2020) as well as informal discussions with native Afrikaans speakers. The result was a list of 60 adjectives, approximately 10 associated with each of the five senses plus 10 which were a little more vague and could be associated with any of the senses. Words were informally placed into these six categories based on the impression of the researcher, who is a native Afrikaans speaker. This was done to ensure that participants were presented with a variety of words across the different senses. These 60 words were then divided into two lists of 30 words each, five words selected randomly from each category.

Table 1: The list of adjectives included in Norming Study 1, informally categorised by modality

	Sight	**Hearing**	**Touch**	**Taste**	**Smell**	**Vague/Other**
List A	flikkerig	lawaaierig	hard	smaaklik	welriekend	neutraal
	helder	diep	skerp	soet	vrot	eienaardig
	blink	ruisend	sag	suur	geurig	wild
	mooi	raserig	koud	bitter	vars	merkbaar
	sigbaar	stil	glad	sout	aromaties	afgryslik
List B	vuil	hoorbaar	tasbaar	proebaar	ruikbaar	waarneembaar
	duidelik	gedemp	rof	aptytlik	reukagtig	fantasties
	welig	hoog	warm	lekker	stinkend	suiwer
	grasieus	laag	prikkelend	ryk	walglik	swak
	lelik	luidrugtig	droog	sappig	sleg	vreemd

Note: See Appendix F for approximate English translations

4.1.2.3. Modality norming section

The modality norming section consisted of 30 questions asking *Tot watter mate ervaar u iets as X?* ("To what extent do you experience something as X?"), where X represents an adjective from the list. For each adjective, each modality was to be rated on a scale from 1, which represented "not at all" (*glad nie*), to 5, which represented "to a large extent" (*tot 'n groot mate*). For example, a participant might be asked "*Tot watter mate ervaar u iets as blink?*" ("To what extent to do experience something as shiny?"), and they might give it a sight rating of 5, a hearing rating of 3, a touch rating of 2, a taste rating of 1, and a smell rating of 1. This indicates that they experience a "*blink*" ("shiny") thing primarily with their sense of sight, and that they do not experience this quality with their sense of smell.

4.1.2.4. Valence norming section

The valence norming section of the survey consisted of a list of 30 questions asking *Hoe laat X u voel?* ("How does X make you feel?"), where X is one of the adjectives from the list. Each

adjective was to be rated on a scale from 1 to 9, where 1 was *baie gelukkig* ("very happy"), 5 was *geen gevoel nie* ("no feeling") and 9 was *baie gelukkig* ("very happy"). Winter (2016) also used similar 9-point valence rating scales.

4.1.2.5. Language background questionnaire

The language background questionnaire consisted of questions about the participants' age, gender, and language background. After indicating their age and gender, participants were asked which languages they spoke. They then rated their proficiency in each language on a scale of 0 to 5, where 0 was *geen* ("none"), 1 was *rudimentêr* ("rudimentary") and 5 was *uitstekend* ("excellent"). They were then required to indicate how often they used each language for everyday oral communication on a scale of 1 to 5, where 0 was *glad nie* ("not at all"), 1 was *selde* ("seldom") and 5 was *gereeld* ("often"). Participants were then asked which language they learned first, from birth. Then, for each of their languages other than the one they learned first, they indicated where they learned it and how old they were when they started learning it. Finally, participants were given the option to enter their email address if they wanted to take part in the lucky draw.

4.1.3. Procedure

4.1.3.1. Participant recruitment

Participants were recruited through the researcher's personal network, including social media. The survey was also advertised to undergraduate students via online announcement forums on modules offered by the Department of General Linguistics at the University of Stellenbosch.

4.1.3.2. Data collection

The entire procedure took place online in one session and was conducted in Afrikaans. When participants clicked on the link to the survey, they were first presented with the consent form.

Once they had read through it and clicked a button to consent to take part in the study, they were taken to an instruction page, which briefly explained the modality norming task. They were also encouraged to answer the questions as quickly as possible, without thinking too hard about their answers. Then they completed the modality norming task, followed by the valence norming task. Finally, they filled in the language background questionnaire. The entire procedure took about 20 minutes to complete.

4.1.4. Ethical considerations

This survey was completed by human participants and therefore ethical clearance was required from REC Humanities. Clearance was first granted on 19 October 2020 (project reference: REC-2020-18930). However, some amendments needed to be made to the project, which were submitted and approved on 5 November 2020. Institutional permission from Stellenbosch University was granted on 27 November 2020, which allows for recruitment of Stellenbosch University students as participants. This ethical clearance process and approval applies to all the procedures detailed in this chapter.

Participants were informed that the study was entirely voluntary. They could exit the survey at any time without any consequences and their responses would not be used in the data analysis. They were not required to give their names and they were informed that their data would only be accessible to the researcher and supervisor and would not be presented in a way that made them personally identifiable. An incentive was offered to participants in the form of a lucky draw, in which they could win one of five R200 cash prizes. If they wanted to participate, they could give an email address. They were informed that this was voluntary, and their contact details would be used only to choose and contact a winner and would not be connected to their responses in any way.

4.2. Corpus study

4.2.1. Corpus

The corpus used for this study is the Virtuele Instituut vir Afrikaans (VivA) Korpusportaal: Omvattend 1.9 (2021). It consists of a collection of 285 438 705 texts, including fiction and non-fiction, with a total of 250 065 569 words. This corpus is automatically lemmatised with approximately 90% accuracy, and tagged for parts of speech, with approximately 75% accuracy (Virtuele Instituut vir Afrikaans, 2021).

4.2.2. Procedure

A series of searches, one for each of the 60 adjectives used in the adjective norming study, were performed. Phrases containing the adjective followed by a noun were searched using Corpus Query Language (CQL). Each search query followed the formula [lemma='X'&pos='B.NW.stellend.attributief'][pos='S.NW.abstrak'], where X represents one of the adjectives from the list. Each adjective was searched as a lemma and it was specified that it was an attributive adjective (B.NW.stellend.attributief) and followed by a noun (S.NW.abstrak). Attributive adjectives were the focus of Winter's (2016) study upon which the present study is based, so for the purposes of comparison the present study also focuses on attributive adjectives. Results were grouped by the lemma to the right. The total number of hits as well as the top ten nouns and the number of hits for each were recorded. For some of the adjectives, there were too few hits to generate a list of 10 nouns. Some adjectives, such as *flikkerig*, generated no hits at all. Once all the repeated words, proper nouns and English words had been removed, this resulted in a list of 345 nouns.

Once this list had been compiled, one more search was done to find the frequency of each possible adjective-noun phrase from the two lists. See Appendix E for the full search query.

4.2.3. Ethical considerations

A portion of the VivA Korpusportaal Omvattend 1.9 is freely accessible, but access to a larger part of the corpus for research purposes must be requested. Access was requested on 26 September 2020 and granted on 28 September 2020. The corpus was used by the researcher for the purposes of this research only and no sensitive personal information was accessed.

4.3. Norming Study 2: Noun valence

4.3.1. Participants

One hundred and forty first language Afrikaans speakers over the age of 18 completed Norming Study 2. The age range was 18-78, with a mean age of 36.56 years and a standard deviation of 15.03. All the participants indicated that they also spoke English. Other additional languages spoken by the participants include isiXhosa, isiZulu, German, Dutch, French, Spanish, Sindarian, South African Sign Language, Korean, Swedish and Chinese. As in the adjective norming survey, the list of words to be normed were divided up to make the survey shorter and more manageable for participants, in order to increase the likelihood of participants completing the entire survey. At the beginning of the survey, participants were randomly assigned to one of five lists. Group 1 normed List 1, Group 2 normed list 2, and so forth. It was found that there was no significant difference between the groups with regard to age ($F = 1.176$, $p = 0.324$).

Table 2: Participant background per group for Norming Study 2

	Group 1 (N = 29)	**Group 2 (N = 22)**	**Group 3 (N = 27)**	**Group 4 (N = 28)**	**Group 5 (N = 33)**
Female	26	18	25	23	27
Male	2	3	2	5	6
Non-binary	1	1	0	0	0
Age (M years)	40.86 (14.64)	38.09 (15.61)	32.70 (14.41)	36.43 (15.18)	35.06 (15.40)

Note: Standard deviation is reported in brackets. N = number of participants in each group

4.3.2. Materials

Similarly to Norming Study 1, this survey was conducted online using the platform Psytoolkit (Stoet, 2010; Stoet, 2017). The survey consisted of a consent form, a valence norming task, and a language background questionnaire.

4.3.2.1. Consent form

The consent form used for this norming survey is the same as the one used in Norming Study 1, except for the brief explanation of the task.

4.3.2.2. Noun list

The list of nouns used in this survey were derived from the Corpus Study detailed in section 4.2.2. The list of 345 nouns was randomly divided into 5 lists of 69 words each.

4.3.2.3. Valence norming task

The valence norming task for this norming study is exactly the same as that for Norming Study 2.

4.3.2.4. Language background questionnaire

The same language background questionnaire was used for both Norming Study 1 and Norming Study 2.

4.3.3. Procedure

4.3.3.1. Participant recruitment

The same procedure was used for participant recruitment for Norming Study 1 and Norming Study 2.

4.3.3.2. Data collection

The data collection procedure for Norming Study 2 was identical to that of Norming Study 1, except that Norming Study 2 did not include a modality norming task. The survey took an average of 8.64 minutes to complete.

4.3.3.3. Ethical considerations

The ethical considerations for this study are identical to those of Norming Study 1.

5. Results

The results of the present study are presented below in three sections. The first concerns the results of Norming Study 1 and the interaction between emotional valence and sensory modality of the 60 Afrikaans adjectives included in this study. The second concerns the results of Norming Study 2, as well as the interaction between the valence of the nouns co-occurring with each of the adjectives in the VivA Korpusportaal Omvattend 1.9, and the dominant modality of each adjective. The third concerns the emotional flexibility of the adjective-noun phrases and the interaction of this emotional flexibility with the dominant modality associated with the adjective in that phrase.

5.1. Emotional valence and modality

All the data for the present study were analysed using LibreOffice Calc and JASP 0.14.3. Each adjective was assigned a dominant modality based on the highest mean scores from the valence norming portion of Norming Study 1. The mean valence was also calculated for every adjective. A simple one-way ANOVA was conducted to investigate the interaction between modality and valence. Post hoc comparisons between the modalities were also conducted to investigate specific difference between the modalities.

Appendix F details which adjectives were assigned each of the dominant modalities. Of the 60 adjectives, the largest number had the dominant modality of sight (N = 23) and the smallest number had the dominant modality of hearing and smell (both N = 7).

Of the five modalities, taste had the highest mean valence at 6.421, whereas smell had the lowest mean valence at 4.125. Furthermore, smell and taste had the highest standard deviations at 2.676 and 2.150 respectively. With regard to the mean valence scores, the word *fantasties* (“fantastic”) had the highest mean valence (8.67) and the word *vrot* (“rotten”) had the lowest mean valence (1.30).

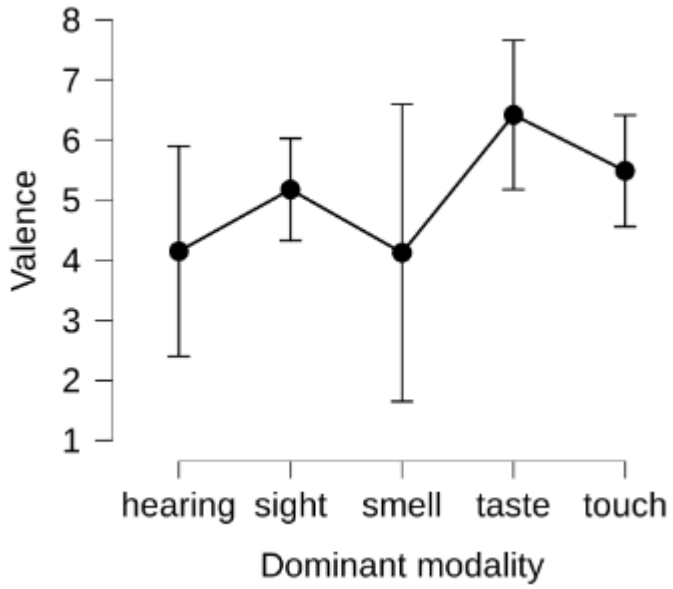

Figure 1: Adjective valence per dominant modality with a 95% confidence interval

A simple one-way ANOVA revealed that the relationship between modality and valence was insignificant ($F(4, 55) = 2.306$, $p = 0.070$, η^2 $p = 0.144$). However, because $p < 0.1$, it can be said that there was a marginal effect and the effect size was large. Post-hoc tests, summarised in Table 3, did not reflect this marginal effect, and also revealed no significant specific differences between the modalities.

Table 3: Post-hoc comparisons between dominant modalities

		Mean difference	**SE**	**t**	**Cohen's d**	**p** $_{tukey}$
hearing	sight	-1.028	0.866	-1.187	-0.527	0.759
	smell	0.025	1.072	0.023	0.011	1.000
	taste	-2.271	0.929	-2.445	-1.096	0.119
	touch	-1.338	1.011	-1.324	-0.870	0.678
sight	smell	1.053	0.866	1.216	0.492	0.742
	taste	-1.243	0.680	-1.828	-0.610	0.368
	touch	-0.311	0.789	-0.394	-0.173	0.995
smell	taste	-2.296	0.929	-2.472	-0.986	0.112

	touch	-1.363	1.011	-1.349	-0.690	0.662
taste	touch	0.932	0.857	1.088	0.504	0.812

Note: p-value adjusted for comparing a family of 5

5.2. Context valence

The mean valence for each of the nouns was calculated based on the ratings from Norming Study 2, excluding the 0 scores indicating that participants did not understand the word. Using these valence scores and the frequency of the adjective-noun phrases derived from the corpus search detailed in section 4.2.2., the context valence for each adjective was calculated. This was done by adding the product of the noun valence with the number of times it co-occurred with the adjective (frequency), and then dividing that by the total number of adjective-noun phrases in which that adjective appeared (total frequency). A simple one-way ANOVA was then used to investigate the interaction between context valence and modality for the adjectives. Post-hoc t-tests were done to investigate the relationship between the adjective modalities with regard to context valence.

The data for the word *stem* (“voice”) was lost, and therefore this word had to be excluded from the analysis. This left 344 nouns in the following analysis. Three adjectives did not appear in in VivA Korpusportaal Omvattend 1.9 in phrases with any of the 344 nouns. These were *flikkerig* (“flickering”), which had the dominant modality of sight, *proebaar* (“tastable”), which had the dominant modality of taste, and *reukagtig* (“odorous”), which had the dominant modality of smell. Hence, these three adjectives were excluded from the analysis, leaving 57 adjectives in the following analysis. A total of 3594 adjective-noun phrases were analysed. The two words that received the highest percentage of 0 scores – the words of which the highest proportion of the participants did not know the meaning – were *vlerkslag* (“wing beat”) (24.14%) and *skaar* (“crowd”) (24.24%). Participants were given the option to indicate that they did not know what a word meant, and across the words, an average of 98.81% of the participants knew what it word meant. The mean valences of the nouns, which were calculated as a score between 1 and 9, varied from 1.59 to 8.52, with a range of 6.93 and a standard deviation of 1.31. The word *lag* (“laugh”) had the highest mean valence (8.52) and the word *misdaad* (“crime”) had the lowest mean valence (1.59). The context valences of the different

modalities were very similar. The smell adjectives had the lowest mean context valence (5,632) and the hearing adjectives had the highest mean context valence (5.889), closely followed by the taste adjectives, which had a mean context valence of 5.882.

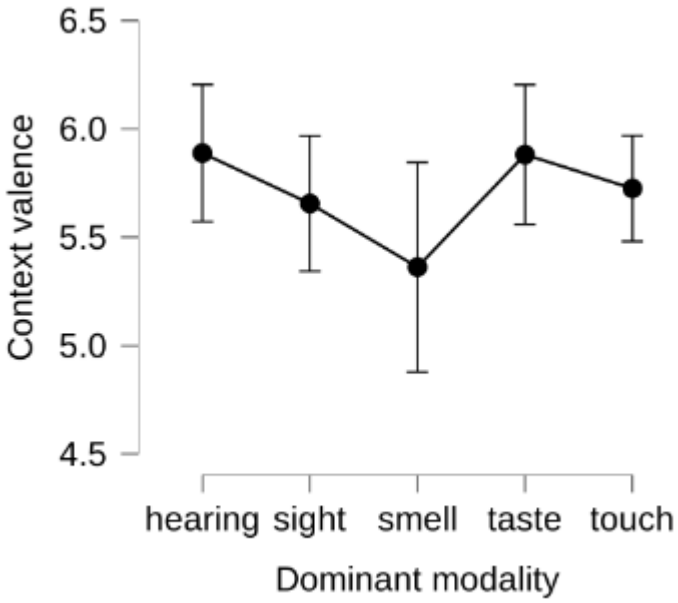

Figure 2: Adjective context valence per dominant modality with a 95% confidence interval

The adjective with the lowest context valence was *hoog* (“high”), which had a context valence of 3.515 and the dominant modality of sight. The adjective with the highest context valence was *blink* (“shiny”), which had a context valence of 6.70 and also had the dominant modality of sight A simple one-way ANOVA revealed no significant interaction between context valence and modality ($F(4, 52) = 1.106$, $p = 0.364$). Post-hoc t-tests revealed no significant differences between context valence of adjectives of the five sensory modalities.

Table 4: Post-hoc comparisons between modalities (context valence)

		Mean difference	**SE**	**t**	**Cohen's d**	**p_{tukey}**
hearing	sight	0.233	0.244	0.954	0.362	0.874
	smell	0.526	0.313	1.683	1.315	0.453
	taste	0.007	0.264	0.026	0.014	1.000

	touch	0.163	0.283	0.577	0.498	0.978
sight	smell	0.294	0.259	1.134	0.441	0.788
	taste	-0.226	0.197	-1.149	-0.349	0.780
	touch	-0.069	0.222	-0.312	-0.112	0.998
smell	taste	-0.520	0.277	-1.873	-1.013	0.344
	touch	-0.363	0.296	-1.226	-0.958	0.737
taste	touch	0.157	0.244	0.642	0.341	0.967

Note: P-value adjusted for comparing a family of 5

5.3. Context flexibility

The data analysis procedure to investigate the emotional flexibility of the phrases was exactly the same as that for the context valence, except that instead of calculating context valence for each adjective, the context standard deviation was calculated. The higher the context standard deviation, the more emotionally flexible the phrase, because that means that the adjective co-occurs with nouns that have both high and low valence (Winter, 2016:981). The context standard deviation for each adjective was calculated as the standard deviation of the valences of the nouns co-occurring with that adjective.

The adjective with the lowest context standard deviation was *blink* (“shiny”) (SD = 0.86) and the adjective *luidrugtig* (“loud”) had the highest standard deviation (SD = 1.65), with the dominant modalities of sight and hearing respectively. The modality with the highest mean context standard deviation was hearing (1.367) and the modality with the lowest mean context standard deviation was touch (1.077).

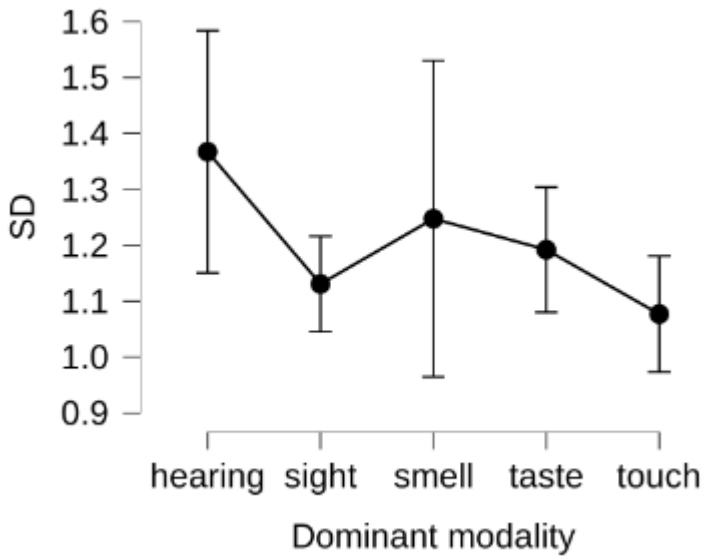

Figure 3: Adjective context valence SD per dominant modality with a 95% confidence interval

A simple one-way ANOVA revealed a significant interaction between dominant modality and context standard deviations of the adjectives, with a large effect size ($F(4, 51) = 2.847$, $p = 0.033$, η^2 $p = 0.183$). Post-hoc t-tests revealed that this interaction was driven by significant differences between the modalities of hearing and sight ($t = 2.844$, $p = 0.048$, $d = 1.167$) and hearing and touch ($t = 3.005$, $p = 0.032$, $d = 1.576$). This effect was large in both cases (Cohen's $d > 0.8$).

Table 5: Post-hoc comparisons between modalities (context flexibility)

		Mean difference	**SE**	**t**	**Cohen's d**	**p** $_{tukey}$
hearing	sight	0.237	0.083	2.844	1.167	0.048
	smell	0.120	0.112	1.067	0.517	0.822
	taste	0.175	0.090	1.951	0.864	0.305
	touch	0.290	0.097	3.005	1.576	0.032
sight	smell	-0.117	0.095	-1.229	-0.587	0.734
	taste	-0.061	0.067	-0.914	-0.322	0.890

	touch	0.054	0.076	0.709	0.301	0.954
smell	taste	0.055	0.101	0.550	0.282	0.981
	touch	0.170	0.107	1.595	0.994	0.507
taste	touch	0.115	0.083	1.384	0.689	0.641

Note: p-value adjusted for comparing a family of 5

6. Discussion and conclusion

In this chapter, the results will be discussed in terms of how they answer the research questions posed at the beginning of the present study. The significance of these results and their implications for the relationship between sensory language and emotion, as well as embodied cognition and the ELH will then be discussed. Finally, the limitations of this study will be outlined and suggestions for future studies will be made.

6.1. Answering the research questions

6.1.1. Adjective modality and valence

The first research question asked to what extent Afrikaans smell and taste adjectives are emotionally valenced, in comparison to adjectives associated with the other sensory modalities. It was the aim of Norming Study 1 to answer this question. It was found that there was a marginal interaction between modality and valence for the adjectives included in the study. Additionally, of the modalities, the taste adjectives had the highest mean valence, and the smell adjectives had the lowest mean valence. This supports, to a minimal extent, previous findings that smell and taste words are more emotionally valenced than those associated with other senses (Lynott and Connell, 2009; Winter, 2016). This also supports findings that English taste words are more positively valenced than English smell words (Winter, 2016). Furthermore, smell and taste adjectives had the highest standard deviations of valence. This suggests that there is the highest variation within the groups of adjectives associated with smell and taste than those associated with the other modalities. However, it is important to note that these differences were not found to be statistically significant. The effects found in the present study, although seeming to support previous findings, are significantly weaker than the robust findings of Winter (2016) in his study on English words. Therefore, although the Afrikaans smell and taste adjectives included in the present study show a tendency to be more emotionally valenced than adjectives associated with the other modalities, this effect is not as robust as previously found for English adjectives (Lynott and Connell, 2009; Winter, 2019).

6.1.2. Valenced phrases

The second research question asked to what extent smell and taste adjectives appear in highly valenced phrases, in comparison to adjectives associated with the other sensory modalities. It was found that there was no significant difference between the modalities when it came to the valence of the nouns that co-occurred with them in the VivA corpus. This means that the phrases containing smell and taste adjectives were not significantly more or less valenced than those containing sight, hearing or touch adjectives. This is in contrast to Winter's (2016) finding that there is a significant effect of English adjective modality on context valence. However, the Afrikaans smell adjectives in the present study had the lowest mean context valence and the hearing adjectives had the highest mean context valence, closely followed by the taste adjectives. The difference is minute, but it does reflect the trend observed above that smell adjectives have a relatively low valence, whereas taste adjectives have a relatively high valence. This is consistent with Winter's (2019) findings on English. In summary, taste and smell adjectives occur in more emotionally valenced phrases to a minute extent.

6.1.3. Emotionally flexible phrases

The third research question was concerned with the extent of the emotional flexibility of smell and taste adjectives in comparison to adjectives associated with the other sensory modalities. It was found that there was a significant effect of dominant modality of the adjective on the emotional flexibility of the phrases within which those adjectives occurred. This main effect is consistent with findings on English (Winter, 2016). However, post-hoc tests revealed that the significant interaction was driven by differences between hearing and sight, and hearing and touch. This means that of the adjectives, those associated with hearing seem to be the most flexible. This is partially in contrast to Winter's (2016:981-982) findings about English, which were that taste and smell adjectives occurred in significantly more emotionally varied phrases, in comparison with adjectives associated with the other senses. However, Winter also found that English hearing adjectives had a relatively high context variability (2016:981-982). Therefore, unlike English smell and taste adjectives, Afrikaans taste and smell adjectives are not significantly more or less emotionally flexible than adjectives associated with the other senses.

6.2. The significance and implications of the findings

6.2.1. The significance of the findings

The findings of the present study suggest that the link between the senses and emotion in language use is not as strong as Winter (2016, 2019) and the ELH claims. According to embodied views on cognition, cognition is shaped by the body, and sensory experience. In other words, there is a strong relationship between perception (the body) and cognition (the mind) (Gallese and Lakoff, 2005:456). The ELH states that this is reflected in patterns of language use (Winter, 2019:81). Previous research on the chemosenses has shown that they have a close relationship with emotions. This has been substantiated by research on human behaviour, such as Herz's (2000) work on memory and olfaction, as well as findings in the field of neurobiology, such as the role of the chemical stimuli associated with smell and taste in trigger reward mechanisms in the brain (Volkow et al.:2011). On the other hand, the relationship between language and the chemosenses seems to be relatively weak, as many widely spoken languages have a relatively small abstract odour and flavour vocabulary, and speakers of these languages tend to have trouble naming odours and flavours (Herz, 2005:1-2) unless they are trained to do so (Ayabe-Kanamura et al., 1998; Croijmans and Majid, 2016). Given the strong relationship between the chemosenses (perception) and emotion (cognition), and the hypothesis that language reflects cognition (Winter, 2019:81), it was hypothesised that Afrikaans language, specifically adjectives, associated with the chemosenses is highly emotionally valenced, more so than language associated with sight, touch and hearing. The results of the present study support this hypothesis to a marginal extent in some respects, but otherwise the results are inconsistent with the hypothesis.

Although the differences were not statistically significant, it was found that adjectives related to taste were overall the most positive, whereas the adjectives related to smell were overall the most negative. This is consistent with previous findings about English (Winter, 2016; Classen, 1993). This has been attributed to the fact that tastes are far more avoidable than smells (Classen, 1993:53). One has to actually put something into one's mouth to taste it, whereas to smell something, one need only to be in its vicinity. Furthermore, it is easier to spit out

something unpleasant than it is to move out of a smelly environment. Therefore, humans are exposed to more unpleasant smells than unpleasant tastes and this is reflected in language.

The present study found that Afrikaans smell and taste adjectives were marginally more emotionally valenced than other adjectives. However, it was not found that they appear in more emotionally valenced phrases, nor do they appear in more emotionally flexible phrases. Adjectives associated with hearing, rather, were found to be the most emotionally flexible, in comparison to adjectives associated with the other senses, particularly sight and touch. This differs from the prediction, based on findings that English smell and taste adjectives are more closely associated with affective language than sight, hearing and touch adjectives, that the most affective qualities of Afrikaans language would relate to taste and smell. Winter (2016:983) found that the differences between the modalities were more pronounced in the context analyses than the individual words. In the present study, the opposite was found: the effects were most visible when the adjectives alone were analysed, rather than the adjective-noun pairs.

6.2.2. Challenging assumptions about language

Overall, the findings of the present study draw attention to the risks of forming hypotheses about language and cognition based on empirical evidence from a limited number of languages. A vast majority of studies on human behaviour and psychology have used participants from Western, Educated, Industrialized, Rich and Democratic (WEIRD) societies. The findings of these studies cannot be assumed to apply to non-WEIRD populations (Henrich, Heine and Norenzayan, 2010). Similarly, assumptions about language have been warped based on languages familiar to WEIRD populations (Majid and Levinson, 2010). The assumption that smells and tastes are universally difficult to name is an example of this. Findings about the odour lexicons of Jahai (Majid and Burenhult, 2014; Majid et al., 2018) and Maniq (Wnuk and Majid, 2014) challenge this assumption These are language spoken by hunter-gatherer communities in Thailand, and therefore its speakers are not considered to be a WEIRD population. It is therefore entirely possible, and arguably likely, that evidence from different languages may challenge any assumptions made about language in general.

It seems, considering the present findings, that one need not venture too far away from WEIRD languages to challenge assumptions about language. Afrikaans is spoken in South Africa, a country that has some WEIRD aspects, but can certainly not be considered WEIRD in the same way that European or North American countries – the countries usually referred to in the literature as emblematic of WEIRD (Henrich et al., 2010) – are. Furthermore, Afrikaans is influenced by Dutch, a language in which the odour lexicon has been shown to be limited (Majid et al., 2018). To the knowledge of the researcher, there is no evidence that there are any obvious known differences between the way these languages speak about the senses. However, the fact that Winter's (2019) findings in English were not replicated in Afrikaans by the present study, shows that differences between languages need not be obvious to challenge assumptions based on these languages.

Winter (2019:190-191) acknowledges that his focus on English is a limitation of his empirical work in support of the ELH, but also notes that these empirical studies can easily be conducted in other languages. They deal with issues central to the field of sensory linguistics, especially regarding the sensory lexicon, the interaction between the senses within this sensory lexicon, and the emotional valence expressed when using this sensory lexicon. Any similar research on languages other than English, such as the present thesis, may uncover new aspects of sensory language and have implications for embodied cognition and the ELH.

6.2.3. Implications for embodied cognition and the ELH

The ELH rests upon the assumption that language activates perceptual simulations of whatever the language is about. Applied to the topics of the present thesis, this means that words associated with smells and tastes activate perceptual simulations of these smells and tastes, which, in turn, influences patterns of language use, particularly when it comes to emotional valence. Despite evidence of mental simulations of visual (e.g. Stanfield and Zwaan, 2001), auditory (e.g. Winter and Bergen, 2012), somasensory (e.g. Lacey et al., 2012), gustatory (e.g. Barrós-Loscertales et al., 2011) and olfactory (e.g. González et al., 2006) perceptual experiences, Speed and Majid (2018) found that perceptual simulations of odours were not

activated in the same way as simulations of sounds. There was some activation, but that was on a lexical-semantic level rather than a full mental representation.

The present study found that on an individual level the adjectives marginally reflected previous findings, in that there was a slight difference between the valences of the adjectives associated with the different modalities, and the taste adjectives were the most positive and the smell adjectives were the most negative. On the other hand, when the contexts within which these adjectives occurred were analysed, the adjectives associated with the chemosenses were not significantly more or less emotionally valenced, nor were they found to be emotionally flexible. This may be because, as Speed and Majid (2018) suggest, only lexical-semantic representations and not full perceptual simulations are activated by words associated with the chemosenses. Speed and Majid (2018) found that the perceived pleasantness of odours was influenced by the presence of matching Dutch odour words, suggesting that the hedonic quality of an odour is mentally activated by a word associated with it. This is consistent with previous findings on the primary role that hedonic qualities play in odour perception (e.g. Poulton, 2020; Yeshurun and Sobel, 2010). The findings of the present study suggest that these lexical-semantic representations do not extend to the contexts within which the adjectives occur, in the way that Winter (2019:79) suggests, but are rather limited to the individual words, and even then the activation of emotional meaning of these adjectives only happens to a marginal extent.

The finding that hearing adjectives are significantly more emotionally flexible than the adjectives associated with the other senses suggests that hearing plays an important role in emotional language in Afrikaans. This can also be taken to suggest that, in general, the hierarchy of the senses with regard to emotional valence differs across languages. Where smell and taste adjectives have been shown to be the most emotionally flexible in English (Winter, 2016), adjectives associated with hearing that are most emotionally flexible in Afrikaans. This is something to keep in mind for similar future research on other languages.

The findings of the current study show that the embodiment of our lexicons and language use is not as obvious as has previously been suggested. Sensory experience is captured differently in different languages and although Winter's (2016) approach of combining English norming

data with English language use in a corpus is designed to uncover subtle linguistic patterns, a deeper look at different languages is needed to uncover underlying linguistic patterns related to the senses. Further research on other languages is required to interrogate the extent to which patterns of sensory language use are embodied.

6.3. Limitations of the present study and recommendations for future research

6.3.1. Limitations and potential adjustments

The current study has some limitations, most of them practical and related to the scale of the study. Due to the limited scope of an MA thesis as well as limited available resources it was necessary that the present study be conducted on a smaller scale than Winter's (2016) study, upon which the present study is based. Steps were taken to produce data representative of valence and modality perceptions, as well as language use, but nevertheless there are some adjustments which could be made to the present method.

Firstly, the number of adjectives included in this study was only 60, in comparison to Lynott and Connell's (2009) 423. This was mainly done to reduce the total number of participants needed to norm all the adjectives, and to decrease time and participant fatigue in Norming Study 1. The researcher's available participant recruitment networks were, based on previous experience, unlikely to contain enough eligible and willing participants to norm more than 60 words. Additionally, three of these 60 adjectives had to be excluded from the phrase analyses because they did not appear in the corpus. This could have been mitigated by performing a corpus search before finalising the list of 60 adjectives. A longer list of adjectives may have been more representative of sensory words in Afrikaans. Furthermore, the list of 60 adjectives used in the present study was compiled mainly using dictionary searches. Corpus searches and possibly free generation tasks performed by native Afrikaans speakers could have generated a different list of common Afrikaans sensory adjectives. Whether such a list would be more representative of sensory adjectives, however, is an empirical question.

Secondly, the present study focuses on adjectives only. Like Winter's (2016) study, the design of the present study could be expanded to include other parts of speech, such as nouns and verbs, to potentially arrive at a more thorough picture of sensory language use in Afrikaans. However, it is uncertain whether such an adjustment would alter or contradict the results of the present study at all.

Thirdly, this study, focuses only on Afrikaans. Like previous studies focusing on English, extending its findings to apply to other languages is risky. However, the methods of the present study may be applied to other languages as well. If the findings of the present study are looked at alongside findings on English, as well as potential future findings on other languages, we may approach a more complete and universal view of the embodiment of sensory language.

Finally, there is a potential adjustment to the data analysis. The present study, like Lynott and Connell's (2009) norming study, assigned a dominant modality to each modality based on the highest mean modality score. However, some of these adjectives were associated with more than one modality to a similar extent. In order to account for this, Lynott and Connell (2009) also calculated a modality exclusivity score for each of the adjectives, which was based on how much more a certain word was associated with one modality over the other four. Incorporating a modality exclusivity score into the analysis might have provided a more nuanced impression of Afrikaans sensory language patterns and valence. This would have been an expansion of the present thesis and is a potential avenue for future research.

6.3.2. Recommendations for future research on sensory language and emotion

The present study aimed to contribute to an understanding of embodied sensory language use by investigating whether findings regarding sensory language, emotional valence and patterns of language use in English could also be found in another language: Afrikaans. The present study did not replicate previous findings on English (Winter, 2016), suggesting that different languages have different patterns of sensory language use. This, in turn, has implications for theories of embodied cognition, such as the ELH. Of particular interest in this respect would be languages that differ more dramatically to English than Afrikaans, especially regarding

sensory lexicon, such as Maniq and Jahai (Majid and Burenhult, 2014; Majid et al., 2018; Wnuk and Majid, 2014). Furthermore, the Afrikaans and English sensory lexicons could be investigated in more depth and compared in an attempt to uncover why patterns of emotionally valenced sensory language use may differ between languages. This proposed line of research would contribute to an understanding of sensory language and cognition with regard to linguistic relativity, which, simply put, is the notion that the language one speaks influences how one thinks, and therefore people who speak different languages think differently (Whorf, 1956: 158).

Another potential avenue of research is the emotional variability of language associated with hearing. The present study found that Afrikaans adjectives associated with hearing occur in more emotionally varied phrases than adjectives associated with the other senses. This is consistent with previous findings on English sensory words (Winter, 2016:982). Future research could explore the emotional flexibility of words associated with hearing.

Related to this, it has also been found that unpleasant odours are associated with disgust sounds in words (Speed et al., 2021). Speed et al.'s (2021) findings represent an angle from which to investigate the relationship between the senses when it comes to valence and embodiment. Despite the common acceptance of models such as the five senses model, which necessarily separate the sense for the purposes of research, human perceptual experience is inherently multimodal. Whilst studies focusing on one sense only are useful, it is important to investigate the interaction between the senses as well, especially considering findings such as Speed et al. (2021). The interaction between modalities in sensory experiences may shed some light on the way in which the senses are encoded in language in relation to emotion, since sound forms part of language.

Through the lens of embodiment, one could also look at the relationship between the emotional valence of words and the way in which they are articulated. The experience of disgust often causes a bodily reaction which may be reflected in language through the sounds used to express disgust as well as sounds commonly found in disgust-related words. The disgust sound [x]

(Speed et al., 2021), for example, is formed at the back of the throat, where one might gag when feeling disgusted.

6.4. Conclusion

This thesis aimed to investigate the emotional valence and flexibility of Afrikaans taste and smell adjectives. Firstly, it set out to explore the extent to which Afrikaans taste and smell adjectives are emotionally valenced in comparison to adjectives associated with the other senses. Secondly, it aimed to determine the extent to which Afrikaans taste and smell adjectives occur in emotionally valenced phrases, in comparison to adjectives associated with the other senses. Finally, it set out to investigate the extent to which Afrikaans taste and smell adjectives are emotionally flexible, in comparison to adjectives associated with the other senses. Based on previous research on the chemosenses, emotion and embodied cognition, it was hypothesised that Afrikaans taste and smell adjectives are more emotionally valenced than adjectives associated with the other senses. In addition to this, it was also hypothesised that they occur in more emotionally valenced phrases, as well as more emotionally varied phrases.

In order to answer these research questions, two norming studies and corpus study were conducted. In Norming Study 1, 60 adjectives were normed by 78 native Afrikaans speakers for modality and valence. In Norming Study 2, 140 native Afrikaans speakers normed a list of 344 nouns for valence. The frequency of the occurrences of the phrases containing these adjectives and nouns in the corpus VivA Korpusportaal Omvattend 1.9 (2021) was collected and analysed using the modality and valence norms.

It was found that the adjectives associated with the chemosenses were marginally more emotionally valenced than those associated with the other senses. However, these adjectives did not occur in more emotionally valenced phrases, nor were they shown to be more emotionally flexible than the other adjectives. The adjectives associated with hearing, on the other hand, were found to be most emotionally flexible. This was inconsistent with the hypotheses that smell and taste adjectives would be most emotionally valenced and flexible in the context of linguistic patterns, and not just by themselves.

This study achieved its aims and highlights the riskiness of making assumptions about language based on a limited number of languages. It challenges the Embodied Lexicon Hypothesis (Winter, 2019), which states that perceptual experience is reflected in patterns of language use. Much of the evidence for this hypothesis comes from English. The findings on Afrikaans suggest that not all languages activate mental simulations of perceptual experiences to the extent posited by the ELH. Some marginal effects suggest some kind of activation, perhaps on a lexical-semantic level, which included valence associations. These activations, however, did not extend beyond the individual smell and taste adjectives. The present findings also suggest that when it comes to valence, the hierarchy of the senses are not the same in all languages. Despite the chemosenses being generally regarded as the most emotional of the senses, evidenced by neuropsychological and behavioural research, it was the adjectives associated with hearing, not the chemosenses, which were found to be most emotionally flexible.

The present study brings a new perspective to sensory linguistics through the language of Afrikaans. The field of sensory linguistics and the ELH is still fairly new and the present study is evidence of the enormous potential for further research on the way in which sensory perception influences language.

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Appendices

The following appendices are given in Afrikaans first, with their English translations below, where applicable. Only the Afrikaans versions were used in the study itself.

Appendix A: Online informed consent form

The consent form below was used for both Norming Study 1 and Norming Study 2, as their informed consent requirements were almost identical. The part indicated in square brackets is applicable to Norming Study 1 only.

Afrikaans

TOESTEMMING OM AAN NAVORSING DEEL TE NEEM

Geagte Voornemende Deelnemer

My naam is Talya Beyers, ‘n student aan die Universiteit Stellenbosch, en ek nooi u graag om deel te neem aan ‘n eksperiment vir my Meesters in Algemene Taalwetenskap (General Linguistics).

U deelname sal heeltemal vrywillig wees en u het die reg om te weier om vrae te beantwoord. U kan die eksperiment enige tyd verlaat sonder om ‘n rede daarvoor te gee.

Die doel van hierdie studie is om ondersoek in te stel na die emosionele waarde van woorde [wat met die vyf sintuie (sig, gehoor, smaak, reuk en gevoel) geassosieer word]. Hierdie navorsing het ten doel om by te dra tot die begrip van die verhouding tussen sensoriese woorde en emosie.

Die vraelys sal ongeveer 15-20 minute duur om te voltooi en sal bestaan uit verskeie vrae oor u assosiasies tussen sekere woorde en die vyf sintuie. U sal ook gevra word om sekere woorde te evalueer op grond van hoe emosioneel u die woorde waarneem om te wees. Dit word gevolg deur ‘n agtergrondvraelys met ‘n paar basiese vrae oor u ouderdom, geslag, en die tale wat u praat.

Indien u aan ‘n gelukkige trekking vir R200 kontant wil deelneem, meld asseblief u eposadres aan die einde van die eksperiment. Die gelukkige trekking sal plaasvind wanneer die data-insameling voltooi is.

REGTE VAN NAVORSINGSDEELNEMERS

U deelname sal heeltemal vrywillig wees. U het die reg om te weier om vrae te beantwoord, en u kan die eksperiment enige tyd verlaat sonder om 'n rede daarvoor te gee. U doen nie afstand van enige regseise as gevolg van u deelname aan hierdie navorsingstudie nie. As u vrae het oor u regte as deelnemer aan navorsing, kontak Mev. Maléne Fouché (mfouche@sun.ac.za; 021 808 4622) by die Afdeling vir Navorsingsontwikkeling.

U antwoorde sal anoniem gehou word en all opname-data sal met ‘n wagwoord beskerm word. Slegs die navorser en studieleiers sal toegang tot hierdie data hê. As u wil inskryf vir die gelukkige trekking sal u kontakbesonderhede nie aan u antwoorde gekoppel word nie.

As u enige vrae oor die navorsing het, kontak gerus die navorser Talya Beyers (19903561@sun.ac.za) en/of die studieleier, Prof Emanuel Bylund (mbylund@sun.ac.za).

Bevestig asseblief dat u aan hierdie opname wil deelneem. Toestemming moet gegee word om die eksperiment te kan voltooi.

Ek gee toestemming ☐

English

CONSENT TO PARTICIPATE IN RESEARCH

Dear prospective participant

My name is Talya Beyers, a student at the Department of General Linguistics at Stellenbosch University, and I would like to invite you to take part in a survey, the results of which will contribute to a research project in order to complete my Masters in General Linguistics.

Please take some time to read the information presented here, which will explain the details of this project.

Your participation is entirely voluntary and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

The purpose of this study is to research [words associated with the five senses (sight, touch, hearing, smell and taste)] and their emotional value. This study aims to contribute to an understanding of the relationship between sensory words and emotion.

The questionnaire will take approximately 15-20 minutes to complete and will contain a combination of questions on your associations between certain words and the five senses. You will also be asked to rate words on how emotional you perceive them to be. Finally, you will fill in a background questionnaire about your age, gender, the languages you speak.

If you would like to be included in a lucky draw to win R200 cash, please indicate so and include your email address. The lucky draw will take place once data collection is completed.

RIGHTS OF RESEARCH PARTICIPANTS

You have the right to decline answering any questions and you can exit the survey at any time without giving a reason. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research participant, contact Mrs Maléne Fouché (mfouche@sun.ac.za; 021 808 4622) at the Division for Research Development.

Your information and response to the survey will be password protected on a device to which only my supervisor and I will have access. Any contact details you provide for the lucky draw will not be linked to your responses.

If you have any questions or concerns about the research, please feel free to contact the researcher, Talya Beyers (19903561@sun.ac.za) and/or the Supervisor, Prof Emanuel Bylund (mbylund@sun.ac.za).

Please confirm that you would like to participate in this survey. Permission is required to complete the survey.

I give permission ☐

Appendix B: Adjective norming questions

Each question below was asked for each of the adjectives. The X represents one of the 60 adjectives included in this study.

Afrikaans

Die volgende vrae gaan oor hoe u eienskappe met u sintuie ervaar. Beantwoord asseblief al die vrae in hierdie vraelys so vining as moontlik, sonder om te hard daaraan te dink.

Tot watter mate ervaar u iets as X?

	1 (glad nie)	2	3	4	5 (tot ‘n groot mate)
Deur dit te sien?					
Deur dit te hoor?					
Deur dit te ruik?					
Deur dit te proe?					
Deur daaraan te raak?					

Beantwoord asseblief die volgende vrae oor u emosionele reaksie op sekere eienskappe

	1 (baie ongelukkig)	2	3	4	5 (geen gevoel nie)	6	7	8	9 (baie gelukkig)
Hoe laat iets wat X is, u voel?									

English

The following questions are about how you experience characteristics with your senses. Please answer all the questions in this survey as quickly as possible without thinking about it too hard.

To what extent do you experience X:

	1 (not at all)	2	3	4	5 (to a great extent)
By seeing it?					
By hearing it?					
By smelling it?					
By tasting it?					
By touching it?					

Please answer the following questions about your emotional reaction to certain characteristics.

	1 (very unhappy)	2	3	4	5 (no emotion)	6	7	8	9 (very happy)
How does something that is X make you feel?									

Appendix C: Noun norming questions

Each question below was asked for each of the nouns. The X represents one of the 344 adjectives included in this study.

Afrikaans

Beantwoord asseblief al die vrae so vinnig as moontlik, sonder om te hard daaraan te dink. As u hierdie vraelys op u selfoon voltooi, draai asb u selfoon om die vraelys in landskapformaat aan te skou. Dit sal dit makliker maak om die hele vraag te sien.

Beantwoord asseblief die volgende vrae oor u emosionele reaksie op sekere woorde. As u nie die woord ken nie, kies 0. Maak seker dat u 'n antwoord in elke lyn gee, anders sal die volgende bladsy nie laai nie. Hoe laat die volgende woorde u voel?

	0	1 (baie ongelukkig)	2	3	4	5 (geen gevoel nie)	6	7	8	9 (baie gelukkig)
X										

English

Please answer all the questions as quickly as possible, without thinking about it too hard. If you are completing this survey on your cellphone, please turn your cellphone to view the survey in landscape format. This will make it easier to see the entire question.

Please answer the following questions about your emotional reaction to certain words. If you don’t know the word, choose 0. Make sure you give an answer in every line, otherwise the next page will not load. How do the following words make you feel?

	0	1 (very unhappy)	2	3	4	5 (no emotion)	6	7	8	9 (very happy)
X										

Appendix D: Language background questionnaire

Afrikaans

Beantwoord asseblief die volgende vrae oor u agtergrond.

1. Hoe oud is u? _____

2. Wat is u geslag?

☐ Vroulik

☐ Manlik

☐ Ander (vul in) _____

3. Dui asseblief aan watter van hierdie tale u praat:

☐ Afrikaans

☐ Engels

☐ isiXhosa

☐ isiZulu

☐ Ander 1 (vul in) _____

☐ Ander 2 (vul in) _____

☐ Ander 3 (vul in) _____

4. Evalueer asseblief u vaardigheid in elke taal (0 = geen; 1 = rudimentêr; 5 = uitstekend)

	0	1	2	3	4	5
Afrikaans						

Engels						
isiXhosa						
isiZulu						
Ander 1						
Ander 2						
Ander 3						

5. Dui aan hoe gereeld u elke taal in u alledaagse modelinge kommunikasie gebruik (0 = glad nie; 1 = selde; 5 = gereeld)

	0	1	2	3	4	5
Afrikaans						
Engels						
isiXhosa						
isiZulu						
Ander 1						
Ander 2						
Ander 3						

6. Watter taal het u eerste geleer (dit wil sê, as ‘n baba)?

☐ Afrikaans

☐ Engels

☐ isiXhosa

☐ isiZulu

☐ Ander (vul in) _____

7. As u enige ander tale praat as die een wat u eers geleer het, dui asseblief aan waar u dit geleer het (skool, speelplek, ens.):

Afrikaans: _____

Engels: _____

isiXhosa: _____

isiZulu: _____

Ander 1: _____

Ander 2: _____

Ander 3: _____

8. As u enige ander tale praat as die een wat u eers geleer het, dui asseblief aan op watter ouderdom u dit geleer het:

Afrikaans: _____

Engels: _____

isiXhosa: _____

isiZulu: _____

Ander 1: _____

Ander 2: _____

Ander 3: _____

9. Baie dankie! Nog net een ding: as u aan 'n gelukkig trekking vir R200 kontant wil deelneem, gee asseblief u eposadres:

Eposadres: _____

English

Please answer the following questions about your background.

1. How old are you? _____

2. What is your gender?

☐ Female

☐ Male

☐ Other (fill in) _____

3. Please indicate which of these languages you speak:

☐ Afrikaans

☐ English

☐ isiXhosa

☐ isiZulu

☐ Other 1 (fill in) _____

☐ Other 2 (fill in) _____

☐ Other 3 (fill in) _____

4. Please evaluate you proficiency in each language (0 = none; 1 = rudimentary; 5 = excellent)

	0	1	2	3	4	5
Afrikaans						
English						
isiXhosa						
isiZulu						
Other 1						
Other 2						
Other 3						

5. Indicate how regularly you use each language in your everyday verbal communication (0 = not at all; 1 = seldom; 5 = often)

	0	1	2	3	4	5
Afrikaans						
English						
isiXhosa						
isiZulu						
Other 1						
Other 2						
Other 3						

6. Which language did you learn first (that is, as a baby)?

☐ Afrikaans

☐ English

☐ isiXhosa

☐ isiZulu

☐ Other (fill in) _____

7. If you speak any language other than the one you learned first, please indicate where you learned it (school, playground, etc.):

Afrikaans: _____

English: _____

isiXhosa: _____

isiZulu: _____

Other 1: _____

Other 2: _____

Other 3: _____

8. If you speak any language other than the one you learned first, please indicate the age at which you learned it:

Afrikaans: _____

Engels: _____

isiXhosa: _____

isiZulu: _____

Other 1: _____

Other 2: _____

Other 3: _____

9. Thank you very much! Just one more thing: if you would like to participate in a lucky draw for R200 cash, please give your email address:

Email address: _____

Appendix E: Phrase search query

[lemma='flikkerig|helder|blink|mooi|sigbaar|lawaaierig|diep|ruisend|raserig|stil|hard|skerp|sag|koud|glad|smaaklik|soet|suur|bitter|sout|welriekend|vrot|geurig|vars|aromaties|neutraal|eienaardig|wild|merkbaar|afgryslik|vuil|duidelik|welig|grasieus|lelik|hoorbaar|gedemp|hoog|laag|luidrugtig|tasbaar|rof|warm|prikkelend|droog|proebaar|aptytlik|lekker|ryk|sappig|ruikbaar|reukagtig|stinkend|walglik|sleg|waarneembaar|fantasties|suiwer|swak|vreemd'&pos='B.NW.stellend.attributief'][lemma='aanduiding|aanval|aarde|aas|afgod|afname|agteruitgang|antwoord|appel|appelkose|area|artikel|asem|aspek|atoom|baard|bad|bate|beeld|been|begin|bergstroom|besering|besigtiging|betekenis|betoging|beweging|bewys|bied|biefstuk|blaar|blaas|blom|boodskap|bos|briesie|brokkie|brom|bron|brood|buiging|buur|daad|dag|daling|deel|dier|ding|dink|diplomasie|dis|dood|dorp|droom|druiwe|eend|eetgoed|effek|eienskap|eier|einde|ekstrovert|enjin|erfenis|ervaring|ete|feit|fluistering|fokus|foto|frikatief|gas|gebeur|gedagte|gedrag|gees|geleentheid|geluid|gereg|gesag|gesels|gesig|geskiedenis|gesprek|geur|gevoel|gewoonte|gloed|goed|goud|graap|gras|groei|groente|groep|grond|haar|hand|hap|hart|heelal|herinnering|herrangskikking|hierna|hitte|hof|hool|houding|hout|huis|idee|identiteit|ingedagte|inhoud|inkomste|inname|insig|invloed|jaar|jag|kant|kind|klank|klere|kleur|klip|klomp|klop|kniebuiging|knou|koffie|kol|kontras|koolwaterstof|kop|kos|kossoort|koste|kritiek|krui|kyk|laf|lag|land|leesstof|lek|lekker|liefde|lig|Lof|loop|lug|lyding|lyf|lyn|maalvleis|maand|maaskaas|maatslag|man|manier|materiaal|meisie|mens|minderheid|misdaad|modder|moeras|molekule|mond|monster|musiek|mynwater|naam|nek|noot|nuus|olie|omgewing|omstandigheid|onderskeid|ontbyt|oog|oomblik|oordrag|oorgang|opgewonde|oppervlak|optrede|Oseaan|pad|pannekoek|parfuum|pasta|perlemoen|pers|plant|plantegroei|plek|poel|polisiëring|posisie|president|produk|profiel|prys|punt|Raad|ras|ratelboek|regering|rekord|rentekoers|restaurant|resultaat|reuk|riglyn|ring|rivier|rolprent|rond|rug|see|seetoestand|selfbeeld|seun|sig|sisgeluid|skaar|skets|skinderstorie|skoen|skuld|skurk|slaap|slag|smaak|snik|snor|soet|somer|soort|sous|span|speler|spier|spoor|spul|spyt|staat|stank|steak|stem|ster|stilte|stof|storie|straat|streep|stroom|struik|stryd|stuk|styging|substitusie|substitusiereaksie|sug|taal|tamatie|tand|teenstelling|teiken|teken|tekere|teleurstelling|temperatuur|terrein|toekoms|toename|toneel|tradisie|tuin|tyd|uitsig|uitspraak|uitwerking|vakansie|veer|vel|verandering|verbetering|verbinding|verkondiging|verskeidenheid|verskil|verskynsel|vertaling|vertoning|verwagting|verwyt|vis|vlak|vleis|vlerk|vlerkslag|voël|vogtigheid|voorbeeld|voordeel|voorval|vorm|vraag|vrou|vrug|vrystelling|vullisterrein|vulsel|vy|vyand|Waarheid|water|watermassa|waterstof|wedstryd|week|wenkbrou|wêreld|wêreldekonomie|werk|werker|werkgewer|werklikheid|wese|wetenskap|wierook|wimper|wind|winter|wond|woonbuurt|woord|wraak|wyn|wys|yskoud'&pos='S.NW.*']

Appendix F: Adjective valence and modality norms

Table 6: 60 Afrikaans adjective valence and modality norms

Dominant modality	**Afrikaans adjective**	**Approximate English translation**	**Valence**
Hearing (N = 7)	*gedemp*	dull	4,04
	hoorbaar	audible	6,16
	lawaaierig	noisy	2,06
	luidrugtig	loud	3,24
	raserig	noisy	1,91
	ruisend	rustling, murmuring	4,91
	stil	quiet	6,73
Sight (N = 23)	*afgryslik*	horrible	1,73
	blink	shiny	6,03
	diep	deep	5,30
	duidelik	clear	7,27
	eienaardig	strange	4,88
	fantasties	fantastic	8,67
	flikkerig	flickering	3,67
	grasieus	graceful	7,76
	helder	clear	6,79
	hoog	high	5,13
	laag	low	4,60
	lelik	ugly	2,76
	merkbaar	noticeable	6,09
	mooi	pretty	8,67
	neutraal	neutral	5,12
	rof	rough	3,64
	sigbaar	visible	6,27
	swak	weak	2,22
	vreemd	strange/foreign	4,33
	vuil	dirty	1,89

	waarneembaar	perceptible	5,91
	welig	lush	5,82
	wild	wild	4,55
Smell	*aromaties*	aromatic	7,76
(N = 7)	*reukagtig*	odorous	4,87
	ruikbaar	smellable	5,69
	stinkend	stinky	1,64
	vrot	rotten	1,30
	walglik	repulsive	1,31
	welriekend	oderiferous	6,30
Taste	*aptytlik*	appetizing	7,91
(N = 14)	*bitter*	bitter	2,61
	geurig	flavourful	8,39
	lekker	nice, delicious	8,56
	proebaar	tastable	6,40
	ryk	rich	5,82
	sappig	juicy	7,00
	sleg	bad	1,82
	smaaklik	tasty	8,45
	soet	sweet	6,91
	sout	salty	5,82
	suiwer	pure	7,53
	suur	sour	4,45
	vars	fresh	8,21
Touch	*droog*	dry	3,93
(N = 9)	*glad*	smooth	6,15
	hard	hard	4,39
	koud	cold	4,79
	prikkelend	prickly, tingly	6,04
	sag	soft	7,36
	skerp	sharp	4,12
	tasbaar	tangible	6,07

warm	warm	6,53

Note: N = number of adjectives

Appendix G: Noun valence norms

Table 7: 344 Afrikaans noun valence norms

Afrikaans noun	**Approximate English translation**	**Mean valence**	**SD**
aanduiding	indication	5,14	1,27
aanval	attack	4,33	2,11
aarde	earth	6,50	2,04
aas	bait	3,71	2,04
afgod	idol	2,57	1,92
afname	decline	3,69	2,09
agteruitgang	deterioration	2,88	1,81
antwoord	answer	6,45	1,63
appel	apple	6,21	1,34
appelkose	apricots	6,11	1,40
area	area	5,13	0,71
artikel	article	5,66	1,84
asem	breath	7,72	1,56
aspek	aspect	5,05	1,21
atoom	atom	4,38	1,50
baard	beard	6,75	1,43
bad	bath	7,27	1,33
bate	asset	6,36	1,96
beeld	image	5,83	1,07
been	leg/bone	5,11	0,96
begin	begin	5,36	2,36
bergstroom	mountain stream	7,41	1,62
besering	injury	2,24	1,41
besigtiging	viewing	5,18	1,37
betekenis	meaning	6,45	1,48

betoging	protest	2,52	1,67
beweging	movement	6,33	1,45
bewys	evidence	6,07	1,30
bied	offer	4,41	1,65
biefstuk	steak	6,29	2,17
blaar	leaf	6,29	1,27
blaas	blow	4,86	1,46
blom	flower	6,79	1,85
boodskap	message	5,32	1,22
bos	bush/forest	6,41	1,92
briesie	breeze	7,22	1,58
brokkie	piece	6,36	1,77
brom	noise, buzz	3,57	2,13
bron	source	6,17	1,75
brood	bread	6,27	1,55
buiging	bow	7,11	1,37
buur	neighbour	4,39	1,47
daad	deed	5,06	1,43
dag	day	6,11	1,42
daling	decline	3,73	1,51
deel	part	5,82	1,47
dier	animal	7,33	1,53
ding	thing	4,55	1,38
dink	think	6,32	1,44
diplomasie	diplomacy	5,59	1,47
dis	dish	6,03	1,67
dood	death	2,52	1,93
dorp	town	5,93	1,77
droom	dream	6,29	2,09
druiwe	grapes	6,14	1,67
eend	duck	4,75	0,93
eetgoed	food	7,05	1,99

effek	effect	5,45	1,27
eienskap	characteristic	5,86	1,79
eier	egg	5,50	2,26
einde	end	4,95	2,63
ekstrovert	extrovert	6,05	1,72
enjin	engine	4,38	1,80
erfenis	heritage	6,03	2,13
ervaring	experience	7,55	1,43
ete	meal	5,11	1,66
feit	fact	6,25	1,46
fluistering	whispering	4,56	1,72
fokus	focus	6,18	1,50
foto	photo	6,88	1,67
frikatief	fricative	4,13	1,94
gas	guest	4,71	1,58
gebeur	happening	5,27	1,28
gedagte	thought	6,86	1,75
gedrag	behaviour	5,04	1,43
gees	spirit	4,86	1,56
geleentheid	opportunity	7,69	1,04
geluid	sound	5,18	1,93
gereg	dish	6,58	1,75
gesag	authority	5,55	1,70
gesels	conversation	2,20	1,58
gesig	face	2,52	1,67
geskiedenis	history	5,55	1,82
gesprek	conversation	6,07	1,30
geur	flavour	6,75	1,43
gevoel	feeling	6,06	1,84
gewoonte	habit	5,32	1,91
gloed	glow	5,46	2,00
goed	things	5,00	0,82

goud	gold	5,56	1,60
graap	grasp	4,56	1,72
gras	grass	6,14	1,67
groei	growth	7,30	1,31
groente	vegetables	6,11	1,42
groep	group	5,14	1,65
grond	ground	5,94	1,50
haar	hair	7,22	1,58
hand	hand	5,14	1,41
hap	bite	4,86	0,71
hart	heart	5,00	0,90
heelal	universe	4,13	1,94
herinnering	memory	7,48	1,66
herrangskikking	rearrangement	6,03	1,68
hierna	hereafter	6,32	1,36
hitte	heat	5,86	1,18
hof	court	1,59	1,08
hool	dump	2,89	2,00
houding	attitude	4,45	2,02
hout	wood	5,18	0,86
huis	house	7,36	1,76
idee	idea	7,45	1,57
identiteit	identity	5,91	1,63
ingedagte	in thought	6,33	1,65
inhoud	contents	5,27	1,31
inkomste	income	6,24	2,86
inname	intake	5,07	1,12
insig	insight	7,21	1,32
invloed	influence	5,52	1,84
jaar	year	5,18	0,86
jag	hunt	3,21	2,07
kant	side	4,86	1,27

kind	child	7,66	1,72
klank	sound	6,69	1,71
klere	clothes	6,76	1,72
kleur	colour	6,29	1,27
klip	stone	5,68	1,39
klomp	group	5,36	1,11
klop	knock	5,52	1,42
kniebuiging	bow	4,41	1,65
knou	setback, damage	6,61	1,47
koffie	coffee	7,18	2,17
kol	spot	4,86	0,71
kontras	contrast	5,82	1,69
koolwaterstof	hydrocarbon	5,63	1,30
kop	head	5,93	1,44
kos	food	7,30	1,42
kossoort	food type	6,11	1,40
koste	cost	6,27	1,61
kritiek	criticism	3,45	2,30
krui	herb	6,27	1,59
kyk	look	5,97	1,55
laf	silly	6,29	1,65
lag	laugh	8,52	1,12
land	land	5,28	2,12
leesstof	reading material	7,00	1,85
lek	lick	4,00	1,45
lekker	nice, delicious	7,61	1,91
liefde	love	6,82	1,28
lig	light	6,93	1,25
lof	praise	7,34	1,52
loop	walk	5,32	1,22
lug	air/sky	7,24	1,62
lyding	suffering	2,52	1,93

lyf	body	5,09	1,91
lyn	line	5,00	0,69
maalvleis	mincemeat	5,89	1,42
maand	month	5,09	0,87
maaskaas	cottage cheese	5,56	1,60
maatslag	beat	5,18	1,42
man	man	5,61	1,20
manier	manner	5,62	1,24
materiaal	material	6,32	1,44
meisie	girl	5,68	2,15
mens	person	6,45	1,47
minderheid	minority	3,32	2,11
misdaad	crime	1,59	1,08
modder	mud	4,79	1,26
moeras	swamp	4,14	1,93
molekule	molecule	4,73	1,82
mond	mouth	5,00	0,82
monster	monster/sample	5,89	1,42
musiek	music	8,14	1,16
mynwater	mine water	5,48	0,98
naam	name	6,18	1,62
nek	neck	5,18	1,30
noot	note	4,68	1,22
nuus	news	4,14	2,20
olie	oil	3,52	2,01
omgewing	environment	6,21	1,55
omstandigheid	circumstance	4,50	1,04
onderskeid	distinction	4,79	1,26
ontbyt	breakfast	7,32	1,28
oog	eye	6,14	1,78
oomblik	moment	6,24	1,37
oordrag	transmission	4,68	1,22

oorgang	crossing	5,10	1,57
opgewonde	excited	7,57	1,73
oppervlak	surface	5,23	1,15
optrede	behaviour	5,33	1,38
oseaan	ocean	6,21	1,55
pad	road	5,58	1,35
pannekoek	pancake	7,57	1,40
parfuum	perfume	7,10	1,76
pasta	pasta	6,79	1,85
perlemoen	perlemoen	4,76	2,17
pers	press	5,62	2,21
plant	plant	6,41	2,28
plantegroei	plant growth	7,21	1,20
plek	place	6,55	1,50
poel	pool	6,09	1,84
polisiëring	policing	3,78	2,09
posisie	position	5,42	1,09
president	president	3,39	1,58
produk	product	5,36	1,73
profiel	profile	5,45	1,30
prys	price/prize	5,97	2,18
punt	point	4,94	1,34
raad	council/advice	5,82	1,47
ras	race	3,52	2,01
ratelboek	rattle book	7,57	1,40
regering	government	2,61	1,64
rekord	record	6,10	1,82
rentekoers	interest rate	6,93	1,21
restaurant	restaurant	6,82	1,28
resultaat	result	5,73	1,51
reuk	smell	5,45	1,87
riglyn	guideline	6,05	1,70

ring	ring	6,25	1,46
rivier	river	7,30	1,47
rolprent	film	6,93	1,21
rond	round	5,07	1,12
rug	back	5,00	0,90
see	sea	5,71	1,76
seetoestand	sea condition	5,57	1,99
selfbeeld	self-image	5,71	1,76
seun	boy	6,06	1,48
sig	sight	6,97	1,84
sisgeluid	hissing sound	3,69	2,24
skaar	crowd	4,92	1,22
skets	sketch	5,36	1,40
skinderstorie	gossip	3,30	2,32
skoen	shoe	5,14	1,65
skuld	guilt/shame	1,71	1,12
skurk	criminal	2,61	1,69
slaap	sleep	7,18	1,31
slag	impact	3,86	2,03
smaak	taste	6,61	1,47
snik	sob	3,06	1,78
snor	moustache	6,50	2,15
soet	sweet	6,91	1,96
somer	summer	5,14	1,27
soort	type	6,09	1,82
sous	sauce	6,10	1,72
span	team	2,81	1,69
speler	player	5,48	0,98
spier	muscle	5,91	1,47
spoor	track	5,43	1,25
spul	stuff	5,04	1,43
spyt	regret	4,57	1,81

staat	state	2,86	1,85
stank	stench	3,50	1,37
steak	steak	6,29	2,09
ster	star	7,27	1,48
stilte	silence	7,32	1,28
stof	substance	5,00	1,41
storie	story	7,18	1,31
straat	street	4,75	0,93
streep	stripe	4,91	0,75
stroom	stream	6,64	1,71
struik	shrub	5,95	1,94
stryd	conflict	3,55	1,60
stuk	piece	5,14	1,41
styging	rise	4,90	2,10
substitusie	substitution	6,93	1,25
substitusiereaksie	substitution reaction	4,67	1,07
sug	sigh	3,73	1,91
taal	language	7,38	1,68
tamatie	tomato	5,18	1,93
tand	tooth	4,39	1,56
teenstelling	contradiction	4,39	1,47
teiken	target	7,36	1,45
teken	sign	5,77	1,93
tekere	carry/go on	3,38	1,93
teleurstelling	disappointment	6,95	1,29
temperatuur	temperature	5,12	1,32
terrein	terrain	2,61	1,83
toekoms	future	6,64	2,15
toename	increase	5,11	1,66
toneel	scene	6,06	1,60
tradisie	tradition	3,95	1,60

tuin	garden	6,21	1,34
tyd	time	5,32	2,06
uitsig	view	7,36	1,45
uitspraak	pronunciation	4,86	1,56
uitwerking	effect	5,15	1,54
vakansie	holiday	2,58	1,30
veer	feather	6,64	1,52
vel	skin	2,46	1,35
verandering	change	5,09	2,50
verbetering	improvement	6,55	1,87
verbinding	connection	5,76	1,48
verkondiging	proclamation	5,00	1,41
verskeidenheid	variety	6,86	1,27
verskil	difference	4,57	1,81
verskynsel	phenomenon	5,55	1,24
vertaling	translation	6,17	1,54
vertoning	performance	7,14	1,51
verwagting	expectation	5,86	2,68
verwyt	resentment	3,10	1,87
vis	fish	5,11	1,23
vlak	shallow	5,11	0,96
vleis	meat	6,36	1,77
vlerk	wing	6,03	1,49
vlerkslag	wing beat	5,23	1,95
voël	bird	6,14	1,46
vogtigheid	damp	6,29	1,65
voorbeeld	example	5,55	1,42
voordeel	advantage	6,46	1,32
voorval	incident	5,86	2,14
vorm	form	5,10	1,21
vraag	question	5,27	1,28
vrou	woman	6,67	1,43

vrug	fruit	4,71	1,58
vrystelling	release	6,33	1,90
vullisterrein	rubbish dump	2,56	1,54
vulsel	filling	5,86	1,18
vy	fig	6,64	1,71
vyand	enemy	2,59	1,47
waarheid	truth	7,57	1,73
water	water	7,11	1,37
watermassa	body of water	5,45	1,60
waterstof	hydrogen	5,21	0,96
wedstryd	competition	6,46	1,32
week	soak	7,61	1,91
wenkbrou	eyebrow	5,11	1,23
wêreld	world	4,50	1,04
wêreldekonomie	world economy	7,21	1,20
werk	work	5,54	2,49
werker	worker	5,07	1,68
werkgewer	employer	5,38	2,32
werklikheid	reality	5,68	1,31
wese	being	5,73	1,98
wetenskap	science	6,18	1,76
wierook	incense	5,46	2,00
wimper	eyelash	4,72	1,41
wind	wind	5,14	2,42
winter	winter	6,21	2,10
wond	wound	2,46	1,35
woonbuurt	neighbourhood	5,21	0,96
woord	word	6,15	1,68
wraak	wrath	2,61	1,83
wyn	wine	6,10	2,69
wys	show	5,68	1,31
yskoud	ice cold	4,39	2,41